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## THE ENDOCRANIUM AND MAXILLARY SUSPENSORIUM OF THE BEE.[1]

BY PROF. GEORGE MACLOSKIE, LL.D.

THE chitinous wall which covers an insect's body and lines its interior, is soft and thin for hinges and other pliable parts, and is hardened in places where rigidity is required. It is furthermore folded outwards or inwards into processes which impart additional strength or protection, or for attachment of muscles. The outgoing folds are seen in the pleura of a lobster (allied to insects) and the wing of a bee, and are always double by nature (including the outgoing and returning plates) with interposed nutritive matter, like the meat in a sandwich.

The outgoing plates (or exodemes) have their counterparts in the internal processes (or endodemes), which usually mark the boundaries between adjacent segments of the body, and which are more or less hardened in particular parts, thus forming an endoskeleton. This internal skeleton is most completely developed in the ventral part of the thorax, and where it forms the endocranium, or internal buttresses of the skull. (It may be observed that the insect has also hard processes of the pharynx and stomach which may be collectively termed its splachnodemes.)

Anatomists have not paid much attention to this class of structures, and some eminent students of insect embryology are as silent regarding the endoskeleton as if they had never heard of

[1] Paper read before the Biological Section of the American Association for the Advancement of Science, Boston, Aug., 1880.

such parts. The few references to them already published, are not distinguished by accuracy. Yet it is patent that all efforts to evolve an insect's embryology, or to give the rationale of its head, ought to include as a preliminary study the structure of its internal economy. In our present essay it is proposed to examine these parts in the honey-bee, and to compare them with their representatives in a few other insects.

The upper part of a bee's cranium consists of three parts, epicranium (Fig. 1, EC), clypeus (C) and labrum (LR). The epicranium is the crown, extending from the occipital foramen at back of the head, right over the vertex, to a transverse suture in front of the insertion of the antennæ (AT). It covers the entire roof and back of the head, and is medially divided in many insects (especially in larvæ) into right and left sections. It is flanked on both sides by the large compound eyes (OC), and is continuous with the cheeks which form the sides of the skull in front of the eyes (G).

FIG. 1.—Internal view of vertex of bee's skull. EC, epicranium; AT, position of antennæ; C, clypeus; LR, labrum; MD, mandible; G, gena, or cheek; OC, ocular or compound eye.

A remarkable feature of the epicranial region is that it has no endodemes, no such ridges or infoldings as to hold out any suggestion of a tendency to segmentation. It has a few ridges near the occipital foramen, and a rim around the eyes and sometimes about the root of the antennæ; but we have found no trace of latent segmentation in this region. This goes against the doctrine that the antennæ represent a segment in the head; and recent discoveries in embryology indicate the same conclusion.[1]

The clypeus, or "face," is the roof of the mouth cavity. At its lateral borders it affords insertion to the mandibular condyles. (In the Doryphora, or potato-beetle, it is curiously turned in with sockets at its angles for the mandibles.) It also shows such involutions as to bring it into close relations with the endocranial system. Its posterior border (that next the epicranium) bends down into a hard transverse ridge, with thick outgrowths at the postero-lateral angles. From these outgrowths descend two pil-

[1] Balfour denies to the procephalic region any correspondence with somites of the body, and says that "the antennæ can hardly be considered to have the same morphological value as the succeeding appendages." (Comparative Embryology, Vol. I, p. 337.)

lars obliquely downward through the cranial cavity (Fig. 2, MC). These mesocephalic pillars are inserted in the floor of the skull just at the sides of the occipital foramen (FO).

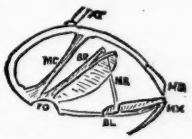



FIG. 2.—Lateral view of bee's skull. FO, occipital foramen; MC, mesocephalic pillars; AT, root of antennæ; BR, basi-suspensorium; MR, medi-suspensorium; BL, basi-labium; MX, maxilla; MD, mandible.

Thus the endocranium consists of a pair of pillars, arising by strong roots from the cranial floor, and fixed above to the clypeus. (The clypeus has to support the mandibles and to afford attachment to many muscles.) Near the top each pillar is forked transversely so as to afford more extensive support. (Fig. 3, MC.)

It is these pillars which render a bee's head so strong, though its shell is rather thin. The mesocephalic pillars of an ant's skull are similar to those of the bee; and we observed short tendons in the neck serving to antagonize them.

FIG. 3.— Diagrammatic view of bee's skull in transverse section. References as in Fig. 2.

The pillars ascend in front of the cerebral brain-lobes, running between them and the ophthalmic lobes, and keep the large ocular apparatus in its proper place.

Burmeister's well-known account of the endocranium of insects has many errors. He represents that of Hymenoptera as rising from the base and ending in two points; he seems to have broken off the pillars and so missed their attachment to the clypeus. He says that Diptera and Hemiptera have no endocranium. This is partially true of the Muscidæ; but we have shown[1] that in all probability the basal part of the proboscis of these insects represents the endocranium, and there is a rudiment of the endocranial roots in a small bridge across the occipital foramen. In the large gadfly *(Tabanus atratus)*, and in the mosquito, we find cephalic pillars as in the bee (besides what seems to be a splachnodeme or pharynx-case supporting the complex oral armature.) *Coreus*, of Hemiptera, though seemingly devoid of mandibles, maxillæ, labium and all processes related to them, has a pair of processes depending from the clypeus, in the position of the upper part of the mesocephalic pillars. These probably support the pharynx and the roots of the long piercing bristles.

[1] See AMERICAN NATURALIST, March, 1880. "On the Proboscis of the House-fly."

Burmeister attributes to Lepidoptera nothing more than a small bar across the occipital foramen. But we find (in the swallow tail, *Papilio turnus)* a strong sub-quadrate frame arising in front of this foramen, and reaching forward so as to be fixed near the roots of the proboscis.

That the mesocranial pillars represent involutions of the outer walls, may be understood from the trunk of the cray-fish, where (as Mr. Huxley has well shown) the ingrowths become plates or ridges, or even pillars. But we find a closer illustration in the heads of some other insects. Cicada has similar pillars with the bee, somewhat flattened out and attached to the sides of the head (the eyes here not reaching so far forward). This would indicate that in the bee the ridges have been displaced inwards by the encroaching of the eyes. (The clypeus of Cicada is transversely barred so as to show about ten pseudo-somites. It is easy to examine these parts from one of its exuviated shells.)

The dragon-fly has a stout ridge below the occipital foramen, sending up processes to the clypeal region, as in the bee. But these processes are broadened out and transparent, and not rigid. The clypeus itself is soft and swollen, and has a deep transverse ridge to meet the processes. Thus the large, weak cranial wall is somewhat but slightly strengthened.

The attempt to correlate the parts of the bee's head with those of the head of the cockroach, gave rise to some interesting revelations. Here Huxley's excellent description of the cockroach ("Anatomy of the Invertebrated Animals") was in good season, but we soon found that his work was superficial and faulty on this part. He states that the endocranium of the cockroach "extends as a cruciform partition from the inner face of the lateral walls of the cranium to the sides of the occipital foramen;" and speaks of the center of the cross as being "pierced by a rounded aperture through which the œsophageal nerve-collars pass." In fact, it is not cruciate in form, but consists of two pillars as in the bee (only softer), and united by membrane some way up, *i. e.*, crotch-webbed like the webbed fingers of a water-fowl. The upper band running across is a fascia binding the two mandibles together (present in the bee, though not thus united with the mesocephalic rods). Thus we have a "tentorium," or mesocephalic plate, forming a thin diaphragm across the middle of the cranial cavity, with thickened borders in front and laterally, and itself concave up-

wards so as to form a channel for the pharynx (Fig. 6, EC). Its perforation is not as in the axis of a cross, but forwards, as if the webbing had ceased at this part. Its correspondence with the parts already described in other insects is easily shown. In the locust the lateral pillars approach more closely, so as to resemble the letter X, but the foramen and other parts are much as in the cockroach.

The Coleoptera appear to want this system. But in following out the relations of the parts I came to a view which, if correct, would explain the anomaly, and which I shall reserve for a later part of this paper.

*B. Maxillary suspensorium.*—It is convenient to examine together the proximal adjustments of both maxillæ and labium (or first and second maxillæ, as they may be called). These are intimately connected in their mode of attachment in all insects possessed of such parts. In the case of the bee they are strung upon a long framework with elbows and hinges, which is able to thrust them out and to draw them in. Of this framework, which we shall call the "maxillary suspensorium," we have not been able to find any satisfactory description or figure. Schmarda's Zoölogy gives a correct figure of its distal part; but neither Schmarda nor Westwood nor Réaumur appears to have traced the structure to its origin. The prize work on the "Anatomy and Physiology of the Bee," by M. Girdwoyn, published by Rothschild, of Paris, is grossly inaccurate at this part. We shall begin its description from its base, where it is inserted close to the inferior insertion of the mesocephalic pillars, immediately in front of the foramen magnum.

At this point there are, below the mesocephalic pillars, two basi-cranial rods, running forwards towards the oral opening (slightly ascending forwards when the mouth parts are retracted, but nearly horizontal when they are protruded). These basi-cranial rods arise similarly with the mesocephalic pillars; but they are united to the sides of an excavated opening in the basis cranii by a thin web, just as the mesocephalic pillars are joined to the side-wall in Cicada. They are not hinged at their root, but are firmly fixed and widen out here, and are slightly pliant, whilst their motion is limited by the web which binds them to the basi-cranial wall (Fig. 5, BR). (An engineering friend to whom we showed this structure, informed us that it involves the

principle of a machine recently patented for producing a slight and steady motion combined with strength.) The two parallel basi-cranial rods are also connected with each other by a very thin and pliable sheet of chitine, which forms the lower bounding wall of the head at the excavated part, and yet allows perfect freedom of motion to the suspensorial mechanism.

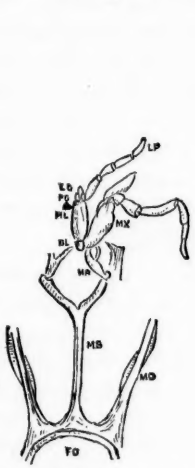
The basi-cranial rods are forked at their distal ends, where they support the *maxillary rami*, one at each side (Fig. 5, MR), which are joined to them by a very perfect elbow-joint, enabling the rami to fold downwards. The rami support the maxillæ, which can thus be protruded or withdrawn. We think that each of these rami corresponds with the cardo or basal segment of the maxillæ of the cockroach or beetle (though this name has been given to the process next to be described).[1]

The *modus operandi* of the maxillæ on these rami is noteworthy. Each maxilla consists of a flat base (stipe), surmounted by a lacinia resembling a knife blade, and bearing a rudimentary palp at the middle; and its lacinia can bend downwards and backwards so as to be out of the way and to present the stipe as a flat projecting plate. When the mouth parts are retracted, the two maxillæ are thus bent down, and their plate-like stipes are approximated, so as to form a hard under lip for the mouth, upon which the mandibles play in their operations (as on a piece of cork, or in cell-making as when the carpenter-bee is operating on wood). The basi and medi-labium then fill the excavated part of the basi-cranial surface. When the suspensorium is being protruded, the thin membrane which borders its proximal joints and which is extended so as to reach the blades of the maxillæ, becomes tense and divaricates them so as to secure their steadiness of motion and to give free play to the intervening labium.

From the distal end of the maxillary rami proceed two *labial rami* to support the labium, thus giving an additional joint, with a hinge which moves freely backward and forward. (This is the piece usually called cardo; we shall call it *labial ramus* of the suspensorium, or labi-suspensorium.) By means of it a very

[1] Dr. Hagen has shown us Wolff's article on "Das Riechorgan der Biene" in *Nova Acta Leop. Carol.*, Band XXXVIII (1875), with beautiful and accurate drawings of the structure of the bee's head. The author does not appear to have studied the parts in the relations here discussed; and he is altogether fanciful in identifying the hard parts and the muscles of the bee's skull with the bones and muscles of the mammalian head.

great degree of motion backwards and forwards is allowed to the labium, which mobility is still further increased by the protrusibility of its ligule or distal piece. The labium consists of a basal piece, usually termed submentum (we would rather call it basi-labium, Fig. 5, BL); of a medial piece, usually termed mentum



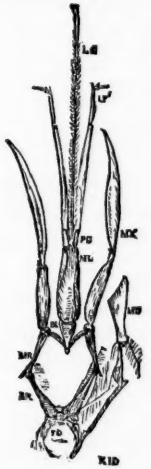




FIG. 4. — Suspensorium and mouth parts of ant. MS, basi-suspensorium; MC, mesocephalic pillar. The other references are as in Fig. 5.

FIG. 5.—Suspensorium and mouth parts of bee. FO, occipital foramen; BR, basi-suspensorium; MR, medi-suspensorium; *below* BL, labi-suspensorium; *to left of* BL, basi-labium; ML, medi-labium; PG, paraglossæ; LP, labial palp; LG, ligule or outer tongue; MD, mandible; MX, maxilla: the terminal part of the maxilla is the lacinia, the basal part is the stipe, its narrow middle part has a rudimentary maxillary palp. One of the endocranial pillars is seen extending from beside the occipital foramen to near the insertion of the mandible.

(we would call it medi-labium, ML), and of what we may call a disti-labium, consisting of paraglossæ (PG), of well-developed labial palps (LP), and of the terminal ligule (LG), about which a great deal has been written.

In such bee-like insects as do not protrude their maxillæ, these parts are more or less simplified, so as often to illustrate and explain the complex arrangement of the bee. Very often the distal parts of the labium are reduced or condensed (so as to resemble somewhat the swollen tip of a housefly's proboscis). In *Stizus grandis*, with non-retractile proboscis, we found the basi-cranial rods to be merely a high ledge running forwards around the excavated part of the basi-cranium, and serving for insertion

of the maxillæ. This shows clearly how the excavation and the rods and connecting sheets arise by an involution of the cranial wall, with thickenings in special tracts.

The large black ant *(Formica pennsylvanica)* carries our thoughts still further. It has only one basi-cranial rod (Fig. 4, MS), extending forward above the basi-cranial wall (which is not excavated). This is derivable from the case of the bee, on the supposition that the basal rods and the margins of the basi-cranial involution have approximated medially so as to coalesce. The ant's suspensorium has a medi-suspensorial pair of maxillary rami (MR), as in the bee; but its labial rami are so small as to be nearly obsolete. Its basi-labium (BL) and its medi-labial case (ML) are much as in the bee; but its disti-labial parts are condensed.

The series of gradations thus attained holds out inducements to pursue the subject, and we may perhaps see the beginning of a new line of discovery in this field. Compare, for example, the maxillary adjustments of the cockroach with those of the insects already described. Here again Mr. Huxley is less happy than usual in his anatomical descriptions. He states that the basal piece or cardo of the maxilla of the cockroach is connected with a thin band which runs round the posterior margin of the epicranium and is firmly united with it only on its dorsal side. He does not indeed represent the maxillæ as directly inserted in the back of the skull, but he regards them as attached to a band which is itself attached to the back or dorsal aspect of the skull, and which he is thus compelled to consider a portion of its exoskeleton. This view, if sustained, would clash with the mode of suspension in the bee, where the maxillæ have been found to have endocranial connections with the base or ventral side of the skull.

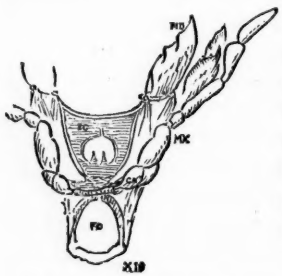



FIG. 6.—Endocranium and maxillary suspensorium of European cockroach (*Periplaneta orientalis*). EC, endocranium; CA, cardo. Other references as in Fig. 5.

A careful examination of the connections in the cockroach, proves, however, that the cardines of the maxillæ are inserted in a ridge which crosses the basis-cranium in front of the occipital foramen (though a slender ridge runs from this part

round the occipital foramen, as usually occurs in insects). This transverse ridge is intimately connected with the roots of the mesocephalic system; and may be deemed a condensed variation of the bee's suspensorium.

The Coleoptera have presented the greatest difficulty here, a difficulty which has been long felt by zoölogists. With the Coleoptera the basi-cranial region is so unlike that of other insects that a special nomenclature has been devised for it; and the terms *mentum*, *submentum* and *gula* are properly confined to the beetles (the application of these terms to other insects has been, in some measure, guess-work). The base of the head failing us as a guide, we started from the other end, or front. Here it was easy to find in the clypeus of Lachnosterna the points from which the mesocephalic pillars ought to descend; and there the pillars actually are, but they appear as involutions of the wall, and they descend not to the vicinity of the occipital foramen, but further forward to the region of the submentum, and near them the maxillary cardines are inserted. The interpretation of these observations is easy. Mr. Huxley has sought the representatives of the beetle's basi-cranial pieces in the neck of the cockroach; the facts now given appear to say that in other insects (as the bee) they are condensed into the very complex and strong system of ridges which borders the front of the occipital opening. The Coleoptera alone have these parts resolved so as to show the primitive arrangement. The fact that they reach the basi-cranium at the point of insertion of the maxillæ, is in complete harmony with what we have seen in the bee. We observed in the basi-occipital region of the head of Lachnosterna, and still more distinctly in the stag-beetle, an overarching frame, enclosing a nervous canal similar to the sternal canal of the thorax. We may, perhaps, detect traces of this in the very intricate cross-bars in advance of the foramen magnum of the bee; so that here the sternal canal and the roots of the mesocephalic and basi-cranial processes are all crowded together. (Thus it is not correct to say that Coleoptera have no endocranium, although Gegenbaur makes a slip when he cites them as an example of largely developed endocranium.)

Only a few words can be added as to the cranial splachnodemes, or that part of the endocranium which consists of hardening of the pharynx. The mouth is floored by a stiff tongue-like plate

(we may call it *lingua*, not to be confounded with the ligule already mentioned). The tip of this lingua is deflected downwards, and from its base run backwards two long barbed processes. Over the mouth is a similar but simpler structure, called epipharynx, and to these the borders of the pharynx are attached, and also muscles. If we force open the mouth (by pulling down the maxillæ), we find the open mouth overarched by epipharynx (connected with the labrum), floored inwardly by the lingua (or inner tongue, formed by the floor of the pharynx), enclosed at the sides by the long tendons of the lingua which are stretched up like faucial door posts. All these hard parts keep open the soft membrane of the pharynx, just as the iron frame of a dredge keeps open the netting attached to it. In the upper part of the cranial cavity are racemose glands which send down a pair of ducts to the inner tongue. The great salivary apparatus of the thorax sends forward its ducts which unite and penetrate through the basi and medi-labium to the ligule or long outer-tongue.[1]

It would be premature, at the present stage of our knowledge, to theorize upon these facts. They indicate a fundamental unity of structure of the heads of all insects; but how far and in what directions it is varied, and what is its relation to other parts of the body, are questions needing further research.

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## MYA ARENARIA IN SAN FRANCISCO BAY.

BY ROBERT E. C. STEARNS.

IN November, 1874, Dr. W. Newcomb, who at that time resided in California, described in the Proceedings of the California Academy of Sciences, a species of Mya which had been given to him by the well-known collector, Henry Hemphill, who detected several specimens of the form on the shore of Alameda county, on the eastern side of San Francisco bay.

The specimens were about two-thirds of the usual average size

[1] Siebold discovered a triple salivary system in the bee; but the text books are still sadly at variance with each other and with the facts, in their treatment of this part of the subject. Some place the bee's salivary glands in the head, some in the thorax, and some say they are sometimes in one part and sometimes in the other!

of *Mya arenaria*,[1] rather fragile in substance and delicate in sculpture.

As Dr. Newcomb considered it a new species, he described it as above and gave it the name of *M. hemphillii*, remarking that "the only species with which it can be confounded is the *Mya præcisa* of Gould, which Dr. Carpenter considers as identical with *M. truncata* of the North Atlantic. A specimen of *M. arenaria*, from Puget sound, in my collection, is quite distinct from this species, and, like many of the circumpolar species, is common to the North Pacific and North Atlantic. It is quite distinct from the fossil *M. montereyi* Conrad, as I am informed by Dr. Cooper, who kindly made for me the comparison of this shell with Conrad's figure and description."

Since 1874, the date of the description, the Mya has become abundant, and is found for miles alongside the easterly shore of the bay, and is now the leading clam in the markets of San Francisco and Oakland, superseding to a great extent the previous "clams," *Macerna nasuta* and *Tapes* (or more properly *Cuneus) staminea* Conrad, in its varieties, especially *diversa* Sby., and the now dominant clam of the fish-stalls, is found exhibiting all of the characteristics of *Mya arenaria*, and is universally conceded to be the same as the Atlantic species.

My friend, Dr. Newcomb, as quoted above, it will be seen, regarded his Puget sound Mya as *M. arenaria;* which is the region from which Gould's form, *Mya præcisa*, was brought, and if related to another form, is more likely to be a variety of the circumpolar *truncata* than to be *arenaria*.

None of the more recent and reliable collectors referred to in Carpenter's Supplementary Report (1863) to the British Association, neither any collector since this date, to my knowledge, has verified the occurrence of *M. arenaria* at any point north of San Francisco bay on the west coast of America. Gould was certainly familiar with a form so common on the New England coast; and though perhaps in this day and generation we hold rather broader views as to what constitutes a species than some of the old mas-

[1] The only bivalve along the coast or in the bay of San Francisco which might be mistaken for or identified with *Mya arenaria* is *Schizothærus nuttalli* Conrad, which when mature is two or three times as large as the largest specimens of Mya. Dwarfed forms of the large species are found at low tide on the flats connected with Goat island on the east. In this species the siphons are enclosed in an external sheath, the same as in Mya, making what the unsophisticated call a "long neck."

ters, yet he certainly would have noticed it, had the shells before him been closely like the more common Linnean species.

Middendorff credits it to Sitka,[1] etc., but this is not supported by any of the numerous subsequent authorities.

As to its presence on the Asiatic side of the North Pacific, Middendorff credits it to "Kamchatka" and the "Ochotsk sea." Jay, in (Vol. II) Perry's Japan Expedition, describes it even as "*M. japonica*," and credits it to "Volcano bay, Island of Yeddo," remarking that it "is very similar to *M. arenaria*." Arthur Adams,[2] who collected in Japan, pronounced it identical. It has also been detected in Hakodadi bay, and Professor Morse says "the typical northern form *(M. arenaria)* lives in the Gulf of Yeddo to-day, and its shells are found in the mounds of Omori."[3]

It must be admitted that the species is found in these Asiatic stations upon the testimony here adduced, but as to its presence on the coast of Western America at any point north of or anywhere outside of San Francisco bay, the fact that neither Nuttall, Jewett, Kennerly, Lord, Swan, Cooper, Harford, Dunn, Hemphill, Hepburn, Fischer, Dall, Newcomb (in the field), and many others, as well as myself, have never detected a specimen prior to the date of my friend Newcomb's description (or since, so far as I can learn), ought to be sufficient evidence on this point.

From whence, then, came the seed which has produced the abundance of this species which has spread and is now spreading rapidly along the shores of San Francisco bay?

Examine the ancient shell heaps and mounds found hereabout, and one may find the thin broken valves of the Macomas, but not a fragment of the shell of Mya. One may find the shells of the native Haliotis and Olivella and the beads and money or ornaments made from them; the bones of the common California deer, of the whales, and perhaps other animals, all of which are still to be found in the neighborhood or not many miles away, but not a piece of Mya. The ancient clam-diggers, whose kitchen-middens are met with in many places on the Alameda and other shores of the bay, whose skeletons and implements are sometimes exhumed or discovered, had "passed over to the majority" centuries before the advent of *Mya arenaria* in California waters. To proceed to the question—was the seed of this mollusk intro-

[1] B. A. Report, 1856, p. 219.

[2] Id. Rep., 1863, p. 588.

[3] AMER. NATURALIST, Sept., 1880, p. 657–8.

duced from the waters of the Asiatic shores of the North Pacific or from the American shores of the North Atlantic? If artificially introduced, of which there can be no doubt—from which direction does the extent and character of the traffic of our commercial intercourse make it most probable that the species came or was brought? By water on the steamships from Japan, or by railroad three thousand miles overland from the Atlantic seaboard?

With the completion and operation of the trans-continental railroad, our oyster men, many of whom have a large capital invested in the business, commenced the importation of small oysters *(O. virginica)* from the Atlantic side, by the car load, for planting in San Francisco bay, where in a season or so they attain a merchantable size, growing exceedingly fat; as yet, efforts to propagate them have not been successful; but the importation still continues as before, the profit to the oyster planter being simply through increase in size and not from multiplication of numbers by propagation.

There is no similar traffic with Japan, and it is hardly possible that the fry of *Mya arenaria*, if it did adhere to the bottom of the steamers in Japanese parts would be able to hold on for so long a time or for so great a distance with the friction of the water against the bottom of the steamer constantly operating to sweep it off.

Native oysters are also imported from various points in Washington Territory, and planted in the bay, but we have no knowledge of the Mya existing at any point in the region from whence these latter oysters are brought.

In the presence of the fact of the rapid increase of this truly excellent edible, next to the oyster the most valuable either as human food or fish bait, of any of this class of food, and the inference from its spreading so readily in San Francisco bay, that other places along the coast might prove equally congenial to it, it would be a wise, public spirited act if the captains of our coasting vessels would take the trouble and incur the slight expense attending the planting of this clam at such points as their vessels touch at in the ordinary course of business.

Since the manuscript of the foregoing matter was sent to the NATURALIST, I have received specimens of *Mya arenaria* from my friend, Dr. C. L. Anderson, of Santa Cruz, for identification. Santa Cruz is on the coast at the northerly end of Monterey bay,

about seventy-two miles south of the entrance to San Francisco bay. The specimens are rather under, than of, the usual size, and were obtained at the mouth of a lagoon near Santa Cruz.

In a few years we may look for its distribution southerly and along and around Monterey bay, the shores of which are well adapted for this species. As to its introduction at Santa Cruz, I hope to be able to give more particular information hereafter.

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## THE SQUID OF THE NEWFOUNDLAND BANKS IN ITS RELATION TO THE AMERICAN GRAND BANK COD FISHERIES.

BY H. L. OSBORN.

THE broad continental plateau which fringes our eastern coast, rises in many places near to the ocean's surface, and forms shallows known in sailor language as "banks." These banks have, on the average, a depth of thirty fathoms, though in some places but seven or eight fathoms, and are a favorite resort of the several species of our most important food fishes, visiting the places to prey upon the many forms of marine invertebrates covering these favoring spots in most luxuriant profusion. In most cases the banks are not extensive, not more than from ten to twenty miles in length, but this rule finds a notable exception in the case of the Grand Bank, off Newfoundland. This shoal is in shape nearly an equilateral triangle; its base is two hundred and seventy miles long, running east, north-east, and lying somewhat east of south-east from the island. This northern edge, furthermore, is sixty miles distant from land, and the intervening water has an average depth of eighty-five fathoms. The edge of this shoal is very clearly defined, the water along the northern limit falling suddenly, in the distance of only a mile or two, from thirty to sixty fathoms, while, on the other sides, the descent is frequently very rapid from thirty to one hundred and eighty fathoms. It has been noted as the most favorable grounds for the capture of the cod since before 1740, at which time seventy vessels from Gloucester alone, scoured the banks, and since which time the number has fluctuated, till at present more than four hundred schooners are engaged in the pursuit. The problem of bait has always been a troubling one to this enormous

fleet. I am told that in early days salt bait of clams or fish was in universal use, but of late some sort of fresh bait has seemed a necessity, and the squid has become the favorite form. This they are forced to procure at Newfoundland, and they have thus opened a new traffic to the people of the island, and caused, too, at times, much hostility and ill-feeling.

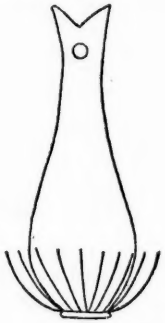
During the summer and fall of 1879, I had the opportunity of spending three months on a codfishing schooner, for the purpose of making zoölogical collections, and also of studying the men and their methods; this gave me a chance to visit a large number of harbors, and to study in some detail the matter of bait.

The bait used during the latter part of the year is the squid; not *Loligo pealii* Les., the common form of the ocean waters south of Cape Cod, but *Ommastrephes illecebrosa* Quatr., a more northern species readily distinguished by its movable eyelids. So many good descriptions and figures of this species are in the reach of every one, that any description of the creature is unnecessary in this place. For accurate description of the wonderful changes of color in the integument, I would refer the reader to Professor Verrill's account[1].

The squid does not appear early in the year, during which time the herring, *Clupea harengus*, and the capelin, *Mallotus villosus*, are used, but "strikes" late in June or early in July, touching first upon the southern points of the island. The natives and the fishermen agree in the opinion that the squid migrates steadily northward during the season, appearing first in the northern harbors two weeks later than in the southern, and finally lingering at northern points in the island after they have entirely disappeared from those further south. One is induced, moreover, to believe in a migration among the squid, from the intermittent manner in which they are captured. At one time they are taken as fast as they can be hauled in, while, again, scarcely any can be caught. Furthermore, captures of different times will often average very differently in size, indicating that those of the same ages move in the same schools, and that one school is replaced by another. Thus on one day we secured a large number of very large squid, the largest measuring 290 mm. and the average 265 mm. from base of tentacles to tip of tail, but on the following day could obtain none whose length was greater than 190 mm.

[1] Invertebrates Vineyard Sound, pp. 442–443, 1874.

Evidence is not wanting to show that the squid do sometimes occur on the Grand Banks. Vessels are reported to have caught their bait while at anchor there, and yet I can but regard this as the exception, and I believe that the habit of the squid is to remain during the summer quite near shore. In examination of the stomach contents of the cod, I saw nothing to indicate the squid's presence on the banks. This to be sure is negative evidence, yet it carries some weight.



Squid jig.

The sole mode of capture of the squid is called "jigging," a term derived from, and descriptive of the process. The only gear is a peculiar hook called a "jig," and a couple of fathoms of "mackerel" line. No bait is employed. The jig is of lead, two inches or thereabouts in length, armed at its base with sharply pointed unbarbed pins radially arranged, and curving upward and outward as represented in the accompanying figure. The jigging is conducted in water of from eight to ten feet, usually from small boats, but occasionally from the vessel's side. The jig is allowed to sink nearly to the bottom, where it is kept constantly vibrating up and down, till the squid is felt upon it. Frequently two jigs are managed, one in each hand.

In its mode of taking the hook, the squid differs from any other animal I have ever met. In place of a nibble followed by a snap with the subsequent struggle for escape, there is a sensation as of some one grasping the hook with his fingers. The squid does not use his mouth in "biting," but merely clasps his tentacles round the jig. The pain from the sharp pins doubtless induces him to escape instantly, but the fisherman who is constantly

jerking the jig up and down, pulls in as rapidly as possible, entangling the squid's arms among the pins, and drawing him through the water so fast that escape is impossible.

The instant he emerges from the water he contracts his body, discharging through his siphon a jet of salt water. This is followed by a sucking in of the air by successive respiratory acts, till in its middle portion his cylindrical body has become almost spherical. By a second contraction, the squid now ejects from his siphon a stream of his black, inky secretion. He will usually make one or two or more contractions in an effort to escape, after which he becomes resigned. Not infrequently it happens that the luckless wight has not the squid unhooked before the inky discharge, and may have this sent at himself, since the siphon points away from the animal and upward. I have often seen a fellow struck full in the face by the inky stream, which event was invariably followed by a stream of almost as black abuse intended for the benefit of the squid.

The squid is unhooked by simply turning the jig upper end downward, when he readily drops off. For the most part they are caught wholly by the natives, the Americans usually preferring to look on or to find amusement ashore, though in some cases the fishermen themselves jig also. This, however, is apt to excite jealousy among the natives, or even such hostile feelings at times as to induce them to forcibly prevent the Gloucester men from catching their own bait, or even to purchase it in their harbor. The scene when the squid are thick is really exciting, the streams rising here and there, in twenty directions at once, point out the rapidity of the catch, and the monotonous noise of the squirt is only varied by an occasional murmur of discontent from this or that unfortunate as he lifts his querulous voice. In the dull time most of the jiggers drop away, leaving only those most long-suffering ones, but they return pell-mell if the frequent squirt shall indicate renewed activity.

The purchase of the squid is made at a certain price per hundred, this being usually thirty-five or forty cents, though occasionally falling as low as twenty-five cents. The price but rarely rises above forty cents, for the profits are too small to permit of its reaching a much higher figure. The number used by a single vessel in only two months is astounding. Our vessel, a small one, made three "baitings," fishing each time about two weeks, and

used in that time 80,000 of the squid. A larger vessel, carrying two more men, would in the same time have probably used over 100,000. As to the whole number of squid used in a single season by Americans alone, I have not sufficient statistics to give an accurate statement, it would, however, be reckoned high in the tens of millions.

In delivering his squid, the native accurately counts them, taking up five at a time and throwing out one at every hundredth for tally. And in this the native stupidity appears, for had he ten thousand to dispose of, he would handle over the entire number rather than estimate their value by weighing or measuring. Since they must be each paid separately, and never have themselves any change, the skipper is forced to carry with him a large supply of fractional pieces, so that he will not unfrequently have one or two hundred dollars on board in five, ten and twenty cent pieces of Newfoundland currency, having secured them at some of the larger towns by a draft on his vessel.

It is very strange that, though such an enormous and often pressing demand for the squid exists, no enterprise has ever been undertaken for facilitating its supply with the least possible delay. A vessel is by no means infrequently delayed two or three weeks, and in the course of her search forced to visit harbor after harbor till she had coasted along-shore three or four hundred miles. To such an extent is this true, that the vessel will often spend more time in the search for bait than it afterward takes to use it up. This trouble might be obviated with the greatest ease, for, in time of plenty, the squid might be preserved in ice to be drawn upon when, in a lull, the catch was not large enough to supply the incoming vessel, and the vessel could then return to her fishing ground with the loss of but a single day. Nor would there be any difficulty in procuring ice in Newfoundland during the winter, nor any danger that the bait could not find a market, for the fishermen would not be long in advertising such a place both far and wide. Even if there were some means of communication between the harbors the trouble would be far less than at present; it would be utterly impossible to drive a horse in most directions, and there is scarcely a telegraph line in the island. Hence when the fisherman seeks bait he must cruise about till he finds it, and at present he spends twice as much time in sailing and bait-hunting as in the actual work of fishing.

When at night the day's catch is brought on board, the men proceed to preserve the squid either by salting them or by placing them in ice. In case the season is growing late the skipper has several thousand well salted and stowed for use when fresh squid can no longer be had. But most of the squid are sandwiched in layers of two or three deep between layers of finely broken ice in bait bins in the vessel's hold. Twenty-five or thirty thousand are thus cared for at a "baiting" and will keep in fit condition for use from two to three weeks. In using them each squid is cut into about five pieces and one piece is used for each hook. The hooks are usually well cleaned by the carnivorous gastropoda which infest the banks and by the various fish which are not caught, so that the same piece of squid is rarely used on two occasions. The fish do not bite with the same avidity at the last of the baiting, the fresh bait securing by far the most fish. The salt squid is nearly useless in the summer and early fall, but late in October, I am told, that they are used with considerable success.

In what I have said, I have made no mention of any use of the squid save by the Americans, but I cannot leave the subject without a brief mention of other uses fully as important as this. The Newfoundlanders themselves use an enormous number, both for bait in their shore fisheries, and as a fertilizer for their land. I have been assured, also, that they are good to eat, but though food materials are not abundant on the island, they are not put to this use there so far as I know. The French, moreover, have very extensive fisheries on the Newfoundland coast fully as important as the American, I should judge, their vast size being insured by a bounty offered by the government to fishermen, and by the practice of reinforcing the numbers from among the national convicts. These French vessels do not seek their own bait as is the case among Americans, but are supplied by vessels, which make a specialty of collecting bait, and spend their time alternately in its search, and in its delivery. To a very large extent, I understand, the French use salt bait, they being content with small catches, while the American is disgusted unless he makes fine hauls every day.

And having thus seen the present importance of this industry, does it not seem strange that it has existed but ten or fifteen years, and that, previously for one hundred and fifty years, innu-

merable fish were captured with salt bait, or the viscera from the catch of the day before? This fact illustrates a most striking characteristic of the American fisherman—the strong conviction that the fish have decided preferences in the matter of bait and will not take any kind which is out of season. He will often spend the entire month of August in fruitless search rather than use herring or capelin and gain but a moderate success; nor could any argument convince him that a codfish would bite at a salt clam while "the fleet was using squid."

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## THE BRAIN OF THE EMBRYO AND YOUNG LOCUST.[1]

BY A. S. PACKARD, JR.

[*Continued from April number.*]

*Structure of the Brain in the Embryo Locust.*—Much light may be thrown upon the structure of different parts of the adult brain if we can trace their origin in the embryo, or in the larval and pupal conditions. Hence, we have, with what material we could obtain, made a series of sections of the embryo and different stages of the larva and pupa, with some results of considerable interest and importance. No one, we belive, has yet examined the topography of the brain of the embryo insect. The only observer who has studied the brain of the larva, as compared with the adult, has been Flögel. Speaking of the cockroach, he says:

"Of special interest would be an investigation of the development of the separate parts of the brain. The difficulty of making preparations of small heads has been such that no particular results have been reached. Still, I can say this much, that in small creatures, 7–8 mm. in length, all the parts are present, only of a finer and more delicate structure than in the large adult 25 mm. in length."

He says that in the Hymenoptera he has discovered much concerning the development of the parts of the brain; that in bee larvæ the calices are present, though very small and with thin walls. The peduncle and trabecula have reached their ultimate proportions more nearly than the cauliculus, which is still very thin. In the larval ants the central body and entire mushroom

[1] Adapted from the 2d Report of the U. S. Entomological Commission, Washington, 1880.

Fig. 5

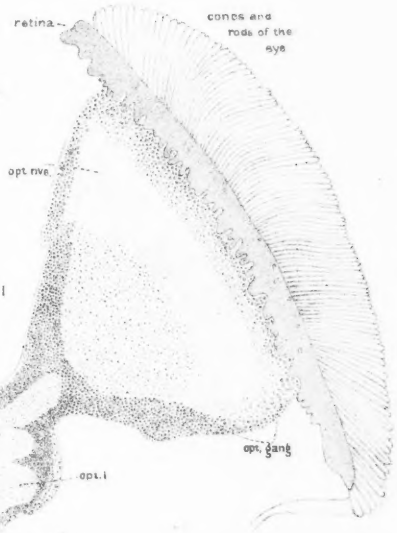



Fig. 1

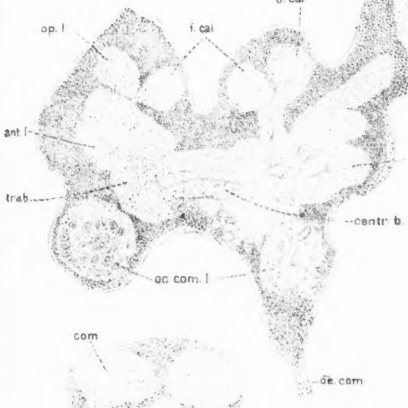


Fig. 6

Fig. 4

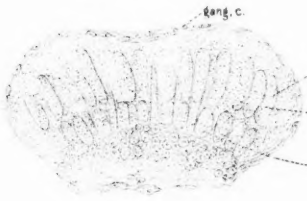



Fig. 2

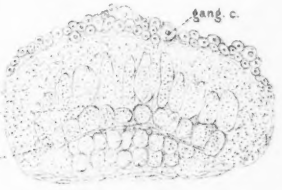



Fig. 3

A.S. Packard, del.

Thos. Sinclair & Son, Lith.

**THE BRAIN OF THE LOCUST.**

bodies are present, though an early larval stage shows, in place of the calices, four symmetrically situated balls of much smaller size; the central body was very flat, and the other parts were wanting. In the pupa all the parts had attained their definite shape. It appears from his observations that the calices are the last to be developed.

He then gives the results of his examination of the brain of caterpillars, as compared with that of the adult sphinx moth. In a caterpillar examined near the time of pupation, the central body is very much undeveloped, forming a small linear transverse body (Querleiste), while the different parts of the mushroom body are indicated. In smaller caterpillars it is scarcely possible to work out the development of the brain. In that of *Pontia brassicæ* the mushroom body and central body were undeveloped, while in that of an Euprepia larva the double stalk of the mushroom body was developed, as well as roundish calyx masses. But in a Noctuid larva the entire mushroom body, including well-developed trabeculæ and a very flat central body, was present.

The brain of the mature pupæ of Lepidoptera, for example *Saturnia carpini*, contains all the portions of the adult brain, and in the same relative proportions. But a brain of *Sphinx ligustri*, in a considerably younger stage of development, did not differ much from the brain of the larva.

We offer the following observations on the brain of the embryo locust, shortly before hatching, with much diffidence, as we are liable to be corrected by future observations in the same directions. The embryos were taken from the egg-shell, hardened in the usual manner, and then cut by Mr. Mason, the sections being frontal, the entire insect being embedded in a mixture of paraffine, wax and oil.

In the youngest stage (which we will call stage A) observed, the body and appendages were formed and the eyes with their facets, the pigment mass coloring the cornea pale reddish.[1]

At this stage, as seen in section 7, the antennal and optic lobes of the brain are indicated, but the central body and mushroom bodies are not yet differentiated. In a plane lying in front of the optic and antennal lobes, the brain is divided in each hemisphere into two regions or lobes, *i. e.*, an upper and lower cerebral lobe. From these embryonic cerebral lobes, are eventually developed

[1] Compare the 2d Report of the U. S. Entomological Commission, Pls. XII, XIII.

the central body and the two mushroom bodies. The stratum of cortical ganglionic cells is, at this period, quite distinct from the paler unstained granular brain matter. The ganglionic cell-portion gradually passes into the central white brain substance, which is composed of fine granules or nuclei alone, and which do not apparently differ from the granules scattered among the ganglion cells. It is to be observed that there are no fibers among the granules. It thus appears that the brain of insects, like the other ganglia, originally consists of a paler portion formed of fine clear granules (nuclei ?), enveloped by a thick, irregular layer of nucleated cells, containing fine granules outside of the nucleus.

As the fibers of the adult brain are evidently secondary products, it would appear that they must be transformed granules or nuclei, and not in all cases, at least, the fibers thrown off from the ganglion cells, although at this time the ganglion cells have no fibers, the fibers of those seen in the adult brain being also secondary growths. It may be that the white inner granulo-fibrous matter of the adult brain is (1) made up of modified granules, which in some cases remain such, and in others form fibers, and (2) of fibers sent in from the cortical ganglion cells.

*Comparison of the Brain at this Stage with the first Thoracic Ganglion.*—If we compare at this stage of development of the nervous system the brain with one of the ganglia of the trunk, we shall obtain a fair idea of the primitive difference between the brain and one of the ordinary ganglia. By a glance at the figures of the two it will be seen that the organization of the thoracic ganglion is essentially simple. It is divided into two portions or regions. The central granular region is enveloped by a thick stratum of cortical ganglion cells. The whole ganglion in section is rudely hour-glass-shaped and much smaller than the brain. There is no differentiation into distinct lobes as in the brain. The formation of the brain, as is well known by embryologists, is one of the earliest steps in the development of the nervous system, the entire system being at an early date in the life of the embryo set apart from the epidermis or integument, the latter with the nervous system originating from the ectoderm or outer germ-layer.

*Second Embryonic Stage, B.*—In embryos more advanced, and just ready to hatch, the eyes being now dark red, the central

body is formed, but our sections do not show any traces of a mushroom body. The sections are frontal, and we will describe them in order. The fifth section is through the head and front part of the eyes, but does not graze the brain itself.

Section 6 passes through the outer portion of the optic and antennal lobes, now clearly differentiated.

In section 7 the cerebral lobes are seen, and in section 8 are larger, as are the optic lobes, while the antennal lobes are somewhat reduced in size. Section 10 passes through the cerebral lobes and also grazes the optic lobes, passing through the optic ganglion.

Section 11 shows the central body, separated from the upper cerebral lobes by a thin layer of loose ganglionic cells. The relation of the central body to the upper and lower cerebral lobes is well shown in this section.

Section 12 passes through the lower cerebral lobes and the upper left cerebral lobe and the optic ganglion. The œsophagus is situated beneath the cleft under the lower cerebral lobes. The next section (13) passes behind the brain, not touching it. These sections are $\frac{1}{500}$ inch thick.

*Structure of the Subœsophageal Ganglion.*—In its form this nerve center is more like the brain than the first thoracic ganglion. The figure is drawn from the youngest embryo observed. The ganglion seen in section is very much larger and quite different in shape from the thoracic ganglia. It expands above the lower fissure between the two sides, being very deep and narrow, while the superior furrow is broad and shallow. The internal paler portion (when magnified 400 diameters) is seen to consist of granules. The stratum of outer cells (the future ganglion cells) is thickest on the outside of the upper part of the ganglion, and at the base of each hemisphere.

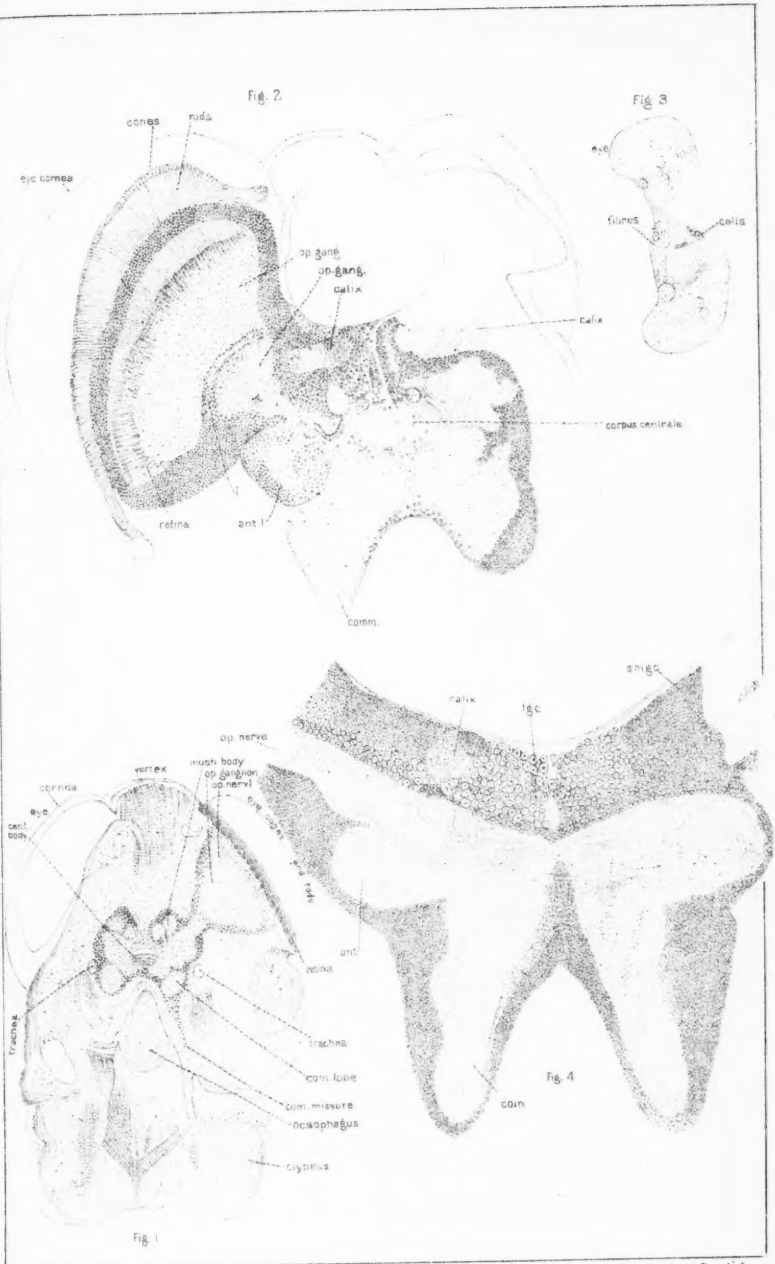
*The Brain of the freshly-hatched Larva of C. spretus.*—In the larva but a few hours after hatching, the brain, so far as I can learn from four sections, does not essentially differ from that of the embryo just before hatching, as the interval is apparently too short for a decided change to take place. It is evident that by the end of the first larval stage the brain attains the development seen in the third larval state of the two-banded Caloptenus.

For illustrations of the different larval and pupal stages of development of the locust, the reader is referred to the first Report of the Commission (Plates I, II, III).

*Third Larval Stage of Caloptenus bivittatus.*—In the third larval condition of another species, the common *Caloptenus bivittatus* of our gardens, the different parts of the brain have attained nearly the same structure and proportions as in the adult. Pl. XIII, Fig. 1, of the second report represents a section passing through the front of the brain, and also the lateral ocelli and the right eye. The ganglion cells surrounding and filling the calices are smaller and more crowded than elsewhere. The mushroom bodies are now formed, though the trabeculæ are not to be seen in our section, but the entire double stalk and calices are very clearly seen. The fibers from the stalk are observed to extend along the inner edge of each calyx and to suddenly stop just beyond the middle. The granular calices contain slight irregularities and sinuous lines, as shown in Fig. 2, *i. cal.*, *o ca.*, but to what these appearances are due it is difficult to say; there are also a few scattered large granules. As the section passes through the front of the brain, where the hemispheres are separated by the frontal furrow, the lobes are not well marked, but the substance is made up of irregular intercrossing bundles of fibers, with the interspaces filled with granulated matter. In Fig. 3 the regular saucer-like form of the calyx is well shown. Fig. 2 is an enlarged view of the right side of Fig. 1, and at this stage large important bundles of fibers are seen passing into the optic, antennal, and commissural lobes.

*First Pupal Stage of Caloptenus spretus.*—My sections are too imperfect to describe, but the form of the brain is closely like that of the next stage.

*Second or last Pupal Stage of Caloptenus spretus.*—A number (14) of very successful sections, made by Mr. Mason from one head, give an excellent opportunity for studying the head of the locust in this stage, just before becoming fledged (see first Report, Pl. 1, Fig. 5). Of these sections, Nos. 8 and 9 pass through the calices and œsophageal lobes, but do not reach the central body. Section 10 (Fig. 1, of Pl. IV) passes through the central body, which is $\frac{1}{500}$ of an inch in thickness, the section itself being of the same thickness. In the optic ganglion the section passes through the front of it, but two lenticular masses appear. The trabeculæ are as in the adult, and the superior and inferior intra-trabecular nerves are clearly seen to pass into the center of each trabecula just as in the adult. On the left side the origin of the cauliculus and peduncle is clearly seen, under a power of 225 and of 400

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THE BRAIN OF THE LOCUST.

diameters, the relation of parts being exactly as in the adult (see Pl. II, Fig. 3). The base of the two divisions of the double stalk arise suddenly, as if inserted into or resting simply upon, rather than arising from, the trabeculæ; the bases of the cauliculus and peduncle being in the same line with the base of the center of the upper division of the central body. It appears as if a few nerve fibers passed under the base of the stalk between it and the trabecula; at any rate, I have been unable to observe either in the pupa, or larva, or adult among a number of preparations, any continuity between the trabeculæ and the double stalk.

In this section the curving of the double stalk backwards and the passage in front of this double column is to be clearly seen, and is just as we have described it from similar sections of the adult brain (Fig. 3 of Pl. II). The ball-like masses in the œsophageal commissures are as distinctly shown as in the adult.

Section 11 passes behind the central body, not showing it nor the basal part of the double stalk of the mushroom body. This section, and those behind it, show well the structure of the optic ganglion. In section 11 the three lenticular bodies clearly appear.

The main, and almost the only difference between the second pupa and the adult appears to be in the degree of development of the central body. In the second pupa (Pl. IV, Fig. 3) it is rather more elementary than in the adult, the upper and lower series of unicellular bodies being a little shorter and rounder, nearer their primitive condition, and the septa between them are plainly fibrous. Their contents are as finely granular as the adjoining parts of the body.

Section 11 is instructive as showing a bundle of directly ascending and obliquely ascending fibers from the back part of the trabecula, of which a portion is contained in the section. Two large bundles enter the commissural lobes, one from above and one from the inner side under the central body, the bundle from above passing down into the lobe from around the upper side of the trabecula. From this fact we should infer that there is a partial nervous communication between the trabeculæ and the commissural lobes. The fibers enveloping the trabecula above are more numerous, the mass of fibers much thicker than in section 10, showing that what we supposed to be fibers separating the stalk from the trabecula appear to be really such.

A broad bundle of fibers is also seen on the right side, passing down from the upper side inside of the upper end of the peduncle, down outside and back of the central body, and is seen to enter the commissural lobe on its inner side, terminating at the point where the ascending fibers to the upper side of the trabecula originate. There is thus a direct communication between the upper part of the brain and the œsophageal commissure in the lower part. It appears, also, that three large nerves or bundles of fibers enter each commissural lobe from above.

At the under side of the commissural lobes the cortical ganglion cells (some of them very large) appear to send their fibers into others to build up the mass of fibers enveloping the lobe. Flögel states that the opinion that the ganglionic cells in winged insects are in direct relation through the fibers with the organs of the body are unfortunately provisionally contradicted by his observations. But here (seen in a portion of the commissural lobe not represented in Fig. 3 of Pl. III), as in one or two other places, we think we have seen fibers from the cortical ganglion cells passing into and aiding in building up the nerves. Such a relation is very plain in the brain of the horseshoe crab, *Limulus polyphemus*.

## EXPLANATION OF PLATE IV.

FIG. 1.—Enlarged view of brain and eye of *C. spretus* in the second pupal stage; × ½ A. This view of the brain is taken from the same preparation (No. 10) as Fig. 1, Plate V. *Centr. b.*, the central body, showing the two series of cells in the lower division and the two rows of unicellular bodies in the superior division; *œ. com. l.*, œsophageal commissural lobes, with the ball-like masses distinctly seen, though this preparation was stained only with picrocarmine; *œ. com.*, œsophageal commissure; *opt. nvl.*, optic nervules; *retina*, retina with rods and cones beyond, the cornea not shown.

FIG. 2.—The central body of adult *C. spretus*, from section 17, showing the inferior and superior divisions, the cells in inferior division (*inf.*), and the two rows of unicellular bodies (*ce. cell. b.*) in the superior division (*sup.*). Magnified 225 diameters.

FIG. 3.—The central body of the second or last pupal state, from section No. 10; *c*, cells in the fibrous septum between the lower and upper divisions of the central body, from section No. 11. × 225 diameters.

FIG. 4.—Vertical section of the subœsophageal ganglion of the cockroach (*Blatta orientalis*), showing the commissure on the left side.

FIG. 5.—A section farther behind, showing the back of the ganglion (*gang.*) of the cockroach, seen separate from the commissure (*com.*).

FIG. 6.—A section through the commissure just behind the ganglion of the cockroach.

## EXPLANATION OF PLATE V.

FIG. 1.—Frontal section No. 10, through the head of second or last pupal stage of *C. spretus*, passing through the middle of the brain, the optic ganglion and eyes,

and cutting across the œsophagus. Drawn in order to show the relation of the brain to the eyes and the exterior of the head; magnified 30 diameters. In the brain, the right mushroom body is seen, while the optic and antennal lobes are not so well marked. The central body (*centr. b.*) is cut through near the middle; below are the trabeculæ (*trab.*); next to the commissural lobes, two tracheæ (*tr.*) or air-tubes passing near the brain. The commissure to the subœsophageal ganglion is drawn on the right side, passing down the œsophagus. In the eye, the cornea, the respective portions composed of rods and cones, the black retina, the stratum of optic nervules, and the optic ganglion and optic nerve passing off from the optic lobe, are all well marked.

FIG. 2.—Section through the brain and eyes of the same second pupa of *C. spretus*, passing through the anterior part of the calices, but not through the central body. The section is oblique and does not well represent the right side.

FIG. 3.—Calyx of the section represented by Fig. 2; magnified 225 diameters. It is composed of granulated nerve substance with a few fibers, the continuation of those of the stalk, and with a few ganglion cells.

FIG. 4—Section through the back of brain of the adult *Locusta carolina*, passing behind the mushroom body, showing the œsophageal commissures, the antennal lobes, and the bundle of nerve-fibers crossing to the right hemisphere. The left calyx is cut through, the microtome-razor passing behind and not grazing the right mushroom body. The distribution of the large (*l.g.c.*) and small ganglion cells (*sm. g. c.*) is well seen in this section. It will be seen that the brain of *Locusta carolina* does not differ in any respect from that of *Caloptenus spretus*, so far as the sections show.

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## EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— It is rumored that at the next meeting of the American Association for the Advancement of Science, to be held in Cincinnati in August of this year, a proposition will be brought forward to extend an invitation to the British Association to depart from their usual custom so far as to come over to this country in 1883, and hold their annual meeting for that year in conjunction with the American Association, at some place hereafter to be fixed upon. A number of the most prominent scientific men in the States and Dominion are known to be in favor of the plan, and doubtless the members of our Association will be glad to send such an invitation as a mark of our cordial feelings towards the students of science in the mother country. It will give us great pleasure if it should prove practicable for the English body to accept. We hope that the proposition may be happily successful. The advantages of such a gathering of scientific men from two countries having a common language, are as evident as they are great. The meetings of the American Association have proved

of inestimable value by bringing the investigators of the continent into personal contact with one another. Every scientific man has not only new facts to present, but also theories and hypotheses which may not be sufficiently complete, or justified by positive knowledge, to be put into print, yet it is precisely these vague ideas which are the most valuable stimulants of discovery, because they are the store from which new and sound ideas can be selected. By no other process can this selection be rendered so efficient as by personal discussion with others whose studies are in the same direction. If the suggested meeting be actually held, it will certainly prove as profitable as delightful. There is no room to doubt that on our part we would be lavish of pains to make the meeting successful, and we think our reputation for hospitality is a guarantee that our guests will have a pleasant as well as a profitable visit.

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## RECENT LITERATURE.

GENTH AND KERR'S MINERALS OF NORTH CAROLINA.[1]—It is perhaps not generally known to the readers of this journal, that the State of North Carolina has nominally carried on a geological survey continuously for a greater number of years than any other of the United States. The bill under which the present State geologist was appointed, and in substance has carried on his survey, was enacted during the legislative session of 1851–52. Professor Ebenezer Emmons was appointed State geologist in 1852, which office he held until his death, in 1863. His son Dr. E. Emmons, Jr., was then nominated, while the present incumbent, Professor W. C. Kerr, was appointed in 1864. It is of course obvious that little or no geological work proper was done or could have been done from 1860 to 1866. It is not our purpose here to refer to the various reports of Professors Emmons and Kerr, published at different times during the progress of the survey, but to call attention to the advance chapter of the report now being published.

Professor Kerr has been exceedingly fortunate in this and preceding publications, in being able to secure the assistance of one who is *facile princeps* of chemical mineralogists in America.

Of the economically important minerals found in North Carolina in sufficient abundance to be subject to exploitation we may mention gold, which has been found in the gravel deposits, and in the quartz veins of the granitic, gneissic, and dioritic rocks and various slates of the country. It is generally alloyed with silver and occurs associated with limonite, pyrite, chalcopyrite, galenite, sphalerite, tetradymite, arsenopyrite, and rarely with altaite and

[1] *The Minerals and Mineral Localities of North Carolina*, being Chapter I of the Second Volume of the Geology of North Carolina. By Professors F. A. Genth and W. C. Kerr, Raleigh, 1881.

nagyagite. The present writer remembers having seen a very beautiful specimen of calcite veinstone well filled with sheet gold, said to have come from North Carolina. The occurrence of gold in calcite veins is very rare, but as the possessors of this specimen supposed the veinstone was quartz, such associations may not be as rare as they are now regarded. We hope that Professor Kerr will endeavor to ascertain if such veins are to be found in the State.

Galenite, sometimes argentiferous, exists in considerable quantity. Chalcopyrite is very abundant and is the only copper ore occurring in sufficient quantity to be relied upon in mining. Some of the copper mines, as for instance the Ore Knob, in Ashe county, are quite well known throughout the country.

Corundum, in association with the peridotite of North Carolina, is quite abundant. It occurs massive in beds from 10 to 14 feet thick, associated with prochlorite, also in hexagonal pyramids, varying from colorless to yellow, deep red, and rarely green shades. It has been mined to some extent, and since, for certain purposes in the arts, the crushed corundum is more valuable than the imported emery, it is to be hoped that the industry will flourish.

Hematite and magnetite are abundant and valuable, while chromite is quite common in connection with the peridotite.

The muscovite mica found in North Carolina has been quite extensively mined since 1868, and is celebrated throughout the United States. According to Professor Kerr, it occurs in eruptive (intrusive) granite dikes in gneisses and mica schists. We would suggest that the term *dike* be used instead of *vein* when speaking of such intrusive forms. We are aware that Professor Dana sanctions the use of the term *vein* in this way, *i. e.* for narrow dikes, but it seems to us that less confusion would result if the word *vein* was only used for the non-eruptive veins. A valuable paper by Professor Kerr on these "mica veins," as he calls them, can be found in the recently published volume of the Transactions of the American Institute of Mining Engineers (1880, VIII, 457–462).

Of minerals whose occurrence is of more especial interest to mineralogists than to the economic geologist, either from their rarity in the State or uselessness in the arts at present, we may mention platinum, found in grains in the gold bearing sands, palladium and the diamond. The latter mineral has been repeatedly found in the State in the gold bearing gravels derived from the gneissic rocks, but never in the itacolumite or its débris. Bismuthinite, tetradymite, argentite, altaite, bornite, chalcocite, barnhardtite, and nagyagite are found, the latter being exceedingly rare, having heretofore only been observed in Hungary.

Again, we may call attention to the presence in the State of covellite, cerargyrite, cuprite, melaconite, spinel in its varieties pleonaste, hercynite, and picotite; gahnite, uraninite, rutile, in beautiful crystals, octahedrite, brookite in the gold sands, braunite,

hausmannite, diaspore, senarmontite or valentintite, bismite, molybdite, enstatite, spodumene, arfvedsonite, beryl abundant and often in beautiful forms, zircon, vesuvianite, allanite, zoisite (thulite), fibrolite, cyanite, topaz of the variety pycnite, euclase, titanite, chrysocolla, pyrophyllite, glauconite, genthite, margarodite, paragonite, culsageeite, kerrite, maconite, willcoxite, margarite, dudleyite, uranotil, uranochre, zippeite, hatchettolite, tantalite, columbite, yttrotantalite, samarskite, euxenite, æschynite, rutherfordite, fergusonite, rogersite, xenotime, pyromorphite in variously colored handsome crystals, monazite, vivianite, olivenite, pseudomalachite, lazulite, scorodite, wavellite, pharmacosiderite, dufrenite, phosphuranylite, autunite, wolframite, scheelite, cuproscheelite, stolzite, anglesite, crocoite, montanite, rhodochrosite, cerussite, azurite and succinite.

It will be seen from the above lengthy list that North Carolina is exceedingly rich in rare minerals; the whole number of minerals now found reaching to 178 species, said to be a greater number than has been observed in any other of the United States. While this indicates great industry and care on the part of the State geologist, we can but think that so many being known is largely due to the great knowledge of rare minerals possessed by Dr. Genth and his skill in detecting them.

The remaining chapters of the volume will be looked for with interest, and we hope that North Carolina will continue the good work.

We may remark, in conclusion, that it would be a great advantage to those States which cannot afford the expense of an elaborate survey, and a saving to their citizens, if they would employ some competent, honest, economic geologist, either part or all of the time, to look after the development of the various mining industries, and place on record such geological facts as he may be able to ascertain. Such a survey as that of Professor Kerr's is not expensive, and is productive of great good in developing the mineral wealth of and in attracting capital to the State, as well as in preventing the foolish and ignorant expenditure of mony on worthless property. Brilliant examples of this last have been shown in some of the Northern States during the past few years, which might have been saved if there had been some *competent* State geologist, or commissioner of mining in them.—*M. E. W.*

MARTIN'S HUMAN BODY.[1]—This work is in the mode of treatment of the subject intermediate between the physiologies of Dalton and of Foster, with valuable features of its own. It gives sufficient information concerning the anatomy of the human body to enable the student to appreciate how that body performs its various

[1] *The Human Body.*—An account of its structure and activities and the conditions of its healthy workings. By H. Newell Martin, D.Sc., Professor of Biology in the Johns Hopkins University, etc. American Science Series. New York: Henry Holt & Co. 1881. 12mo, pp. 621, 34. $2.75.

functions. We like the plan of the book, which bears marks of care in preparation and cautious treatment, while the statements are made in a clear simple way, which will make the book of use to advanced college classes, but more especially to teachers. So vast at the present day is the science even of human physiology, so much has been worked out of late, that it is difficult to put in a convenient compass all the information which the student, and more especially the teacher, should have. Where it has seemed profitable, hygienic topics have been treated briefly, and in an appendix the subject of reproduction and development, with their practical bearings, has been well, briefly and sufficiently discussed. The book is sold with or without the appendix. The work is well rounded, comprehensive in its treatment, and as the latest work of the kind is commended to students as well as to teachers. The illustrations are good and sufficiently abundant; a fair number are original.

VERRILL'S CEPHALOPODS OF THE EAST COAST OF NORTH AMERICA.[1]—This paper contains descriptions, accompanied by excellent lithographic plates, of the different cephalopods discovered in 1880 by the dredgings made by the Coast Survey and the U. S. Fish Commission. Until lately it was not suspected that we had such a rich assemblage of these interesting animals upon our coast, but thanks to the liberal spirit shown by the U. S. Coast Survey and the U. S. Fish Commission, government aid has extended and fostered the labors of the naturalists interested in these studies. All of the species mentioned in this paper, with one exception, are new to science; four of the genera are new, and all the forms inhabit depths off our coast from about 100 to 1632 fathoms.

The drawings illustrating Professor Verrill's descriptions were made by Mr. Emerton; the subjects are difficult to render, but probably no more truthful delineations of these animals have ever been published than these illustrating this brochure.

MINOT'S STUDIES ON THE TONGUES OF REPTILES AND BIRDS.[2]—This memoir consists mainly of a description of the soft parts of the tongue of the mocassin snake *(Ancistrodon piscivorus)*, with the addition of observations on the tongue of the rattlesnake, the common garter-snake, with two lizards, chameleon and *Ameira surinamensis*, and the mocking-bird. Hitherto nothing has been

[1] Report on the Cephalopods, and on some additional species dredged by the U. S. Fish Commission Steamer *Fish Hawk*, during the season of 1880. By A. E. Verrill. Bulletin of the Museum of Comparative Zoology, at Harvard College. Vol. VIII, No. 5.

Reports on the results of dredging under the supervision of Alexander Agassiz on the east coast of the United States, during the summer of 1880, by the U. S. Coast Survey Steamer *Blake*, Commander, J. R. Bartlett, U. S. N., commanding. Cambridge, March, 1881. 8vo. pp. 17.

[2] Studies on the Tongues of Reptiles and Birds. By Charles S. Minot. (From the Anniversary Memoirs of the Boston Society of Natural History). Boston, 1880. 4to. pp. 20.

done upon the histology of the tongue of these animals, and it is a favorable sign that in this country where so little has been accomplished in histology, that these studies should originate here.

The paper is illustrated by a rather coarse but well-drawn lithographic plate, and photo-engravings in the text. The author's conclusions are rather long and technical for reproduction in these pages, but we can commend the paper as most excellent in its kind and of interest to the many who study birds, and especially so to the very few who are concerned with the reptiles.

NATURAL HISTORY OF COLEOPTERA.—Rupertsberger's "Biologie der Käfer Europas," which was acknowledged in the March number of the NATURALIST, will be of great assistance to the student of the earlier states of the Coleoptera. The European literature of this branch of Coleopterology has become quite extensive since the publication of the well-known catalogue, by Chapuis and Candèze, and it was always a difficult matter to ascertain whether and just where any particular beetle larva had been described or figured. The very handy, well arranged and carefully executed work of Mr. Rupertsberger, who was already favorably known as the author of several valuable papers on the habits and early history of European beetles, does away with the difficulty. The number of species enumerated, of which either the earlier states, or at least the habits, have been described is remarkably large when compared with the small number of Coleopterous larvæ described in our own country.

REPORT OF THE STATE GEOLOGIST OF NEW JERSEY[1].—The annual report of the State Geologist of New Jersey, Professor Cook, contains among other interesting information, a classified catalogue of the iron mines of the Highlands of the State. Also a geological map of the valley of the Passaic river and its surroundings. The upper part of the valley is supposed to have been a glacial lake.

The chapter on surface geology is full of interest. The author, however, rehearses a number of facts which had already been published by Professor H. C. Lewis in his paper on the Trenton gravel, etc., in the Proceedings of the Philadelphia Academy, and adopts a number of the views there set forth as to age of gravels, &c., but without giving credit to the earlier publication.

KINGSLEY'S NOTES ON CRUSTACEA.[2]—These notices contain descriptions of new species of crabs, with rectifications of synonymy and facts in their geographical distribution, based on the collection in the museum of the Academy of Natural Sciences of Philadelphia. The second notice is devoted to a revision of the fiddler-crabs or Gelasimi. The value of Mr. Kingsley's work on this genus con-

[1] *Geological Survey of New Jersey.* Annual Report of the State Geologist for the year 1880. 8vo. Trenton, John L. Murphy.

[2] Carcinological Notes, No. 1, 2, 3, 4. From the Proceedings of the Academy of Natural Sciences, Philadelphia, 1880. 8vo. pp. 34–37, 135–155, 179–224.

sists mainly in the reduction of species of this large group, and his work bears evidence of care and judgment. It is accompanied by two plates giving outline figures of the "hands" of these crabs. The third notice comprises a revision of the genus Ocypoda or sand-crabs, and here the author has no doubt wisely reduced the number of nominal species of the genus. In the fourth series of notes is given a synopsis of the Grapsidæ.

RECENT BOOKS AND PAMPHLETS.—Das System der Medusen. Erster theil einer monographie der Medusen. Von Dr. Ernst Haeckel. 1 Vol., folio, pp. 672, plates 40. Jena, 1879. From the author.

The structure and affinities of Euphoberia Meek and Worthen, a genus of Carboniferous Myriapoda. By S. H. Scudder. (From Amer. Journ. Sci., Vol. XXI, March, 1881.) pp. 5. From the author.

The stomach and genital organs of Astrophytidæ. By Theodore Lyman. (Bull. Mus. Comp. Zool., Vol. VIII, No. 6.) pp. 9, plates 2. From the author.

On the temporal and masseter muscles of Mammals. By Harrison Allen, M.D. (Proc. Acad. Nat. Sci., 1880.) pp. 12. From the author.

On a new species of Iguanodon found in the Kimmeridge clay. By J. W. Hulke. (From the Quart. Journ. of the Geol. Soc., Aug., 1880.) pp. 26, plates 3. From the author.

The mineral resources of the Hocking valley. By T. Sterry Hunt, LL.D. 8vo, pp. 152, and one map. 1881. From the author.

The Development of the Squid, Loligo pealii Les. By W. K. Brooks. (Anniv. Mem. Boston Soc. Nat. Hist.) 4to, pp. 22, plates 3, 1880. From the author.

Studies on the Tongue of Reptiles and Birds. By C. S. Minot. (Anniv. Mem. Boston Soc. Nat. Hist.) 4to, pp. 20, one plate, 1880. From the author.

Die Jungen Ablagerungen am Hellespont. Von Frank Calvert und M. Neumayr. 4to, pp. 22, two plates, 1880. From the authors.

Second Annual Report of the Department of Statistics and Geology of Indiana. 8vo, pp. 544, plates 11, one map, 1880. From the department.

Monographie des Mammifères Fossiles de la Lombardie. Par M. Emile Cornalia. 4to, pp. 95, plates 28. Milan, 1858–71.

Carattere marino dell'Amfiteatro morenico del lago di Como. Per A. Stoppani e G. Negri. 8vo, pp. 77. plates 4. Milano, 1878. From the authors.

Mission Scientifique au Mexique et dans l'Amérique Centrale. Recherches Zoologiques. Troisième partie. Etudes sur les Reptiles et les Batraciens. Par MM. Auguste Duméril et Bocourt. Folio, pp. 441–488, plates 6. Paris, 1881. From the authors.

Gaceta Cientifica de Venezuela. Año IV, No. I, Feb., 1881. Carácas. From the editor.

Notes on Liberian Coffee. By D. Morris. Folio, pp. 14. Jamaica, 1881. From the author.

Biennial Report of the State Geologist of the State of Colorado, for the term ending Dec. 31, 1880. 8vo, pp. 75. Denver, 1881. From the State geologist.

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## GENERAL NOTES.

### BOTANY.[1]

ON THE EVAPORATION OF WATER FROM LEAVES (TRANSPIRATION).—The following investigations, made by Miss Ida Twitchell, in the Botanical Laboratory of the Iowa Agricultural College,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

during the year 1881, are important as throwing light upon the nature of plant evaporation, and its dependence upon light and heat. Dehérain's experiments (*Chimie Agricole*, p. 175) appear to indicate that the evaporation of water by the leaves of plants takes place almost as freely in a saturated atmosphere as in the open air, evaporation being regarded as a strictly vital process. As the accuracy of Dehérain's results depend upon the perfect saturation of the air in his experiments, some careful experiments were first made upon so-called saturated atmospheres. Wet sponges were placed in bell jars and were found to continue to lose water by evaporation long after the moisture began to condense upon the sides of the bell-jars. A psychrometer was next placed under a bell-jar which fitted tightly upon a ground glass plate. A number of saturated sponges were placed in the jar also. The humidity as shown by the psychrometer rose from 71 per cent. at the beginning of the experiment (8.55 A. M.) to 95 per cent. fifteen minutes later. It remained at or near this point for nearly eight hours (7 hrs. 55 mi.), when at 5.10 P. M. saturation was reached, both thermometers indicating 84° F. During the experiment the temperature gradually rose from 73° F. (dry) to 84½° F. at 4.20 P. M., the two thermometers differing then but half a degree. At 5.10 P. M. the temperature dropped half a degree, when complete saturation was for the first time reached. These observations show that perfect saturation is obtained with considerable difficulty, as the experiments upon leaves are ordinarily performed, and they indicate that it is desirable to carefully review the whole question of plant evaporation.

As one step in this review, the following experiments were made to determine the nature of the influence of light and heat upon evaporation from leaves. A glass bottle with two openings was filled with water, the temperature of which was varied to suit the requirements of the experiment, and to keep the temperature more nearly constant this bottle was set into another glass jar filled with water having the same temperature. A thermometer was placed in one of the openings, and through the other a six-inch test-tube was thrust up to its top. Into this test-tube a cork was fitted, which was covered with tinfoil to prevent its absorbing moisture. This was the weighing cork, and had a loop of platinum wire attached to it, by means of which the whole could be hung upon the hook of the weighing scales. Another cork was similarly prepared, and then split open and a healthy leaf of Orchard Grass (*Dactylis glomerata*) placed carefully between the two halves. By means of tinfoil and putty the cork was rendered impervious to moisture, while not interfering with the healthy and normal action of the leaf, which was still attached to the plant.

The test-tube, with a small thermometer in it, and the weighing cork in place, was then accurately weighed and put into one of the

openings of the bottle and allowed to remain there until the small thermometer remained constant at about the temperature of the surrounding water. The weighing cork was then quickly changed for the one attached to the grass leaf. After leaving the grass leaf in the test-tube for half an hour, the weighing cork was put in place again, and the test-tube weighed, care being taken to remove completely all the external moisture. The following table embraces the results. The weights are given in grams and decimals, and the temperatures in degrees of Fahrenheit's thermometer. The same leaf was used in all the experiments, excepting Nos. 16 and 17. The observations were continued through several days.

| | Light. | Temperature. | Weight of empty tube. | Weight of tube after ½ hour. | Increase(=water evaporated). |
|---|---|---|---|---|---|
| 1 | Sunshine..... | 45-52 | 25.8700 | 25.8853 | 0.0153 |
| 2 | " ..... | 41-45 | 25.8670 | 25.8814 | 0.0144 |
| 3 | " ..... | 45 | 25.8665 | 25.8780 | 0.0115 |
| 4 | " ..... | 50 | 25.8650 | 25.8739 | 0.0089 |
| 5 | " ..... | 43-48 | 25.8619 | 25.8713 | 0.0094 |
| 6 | " ..... | 48 | 25.8619 | 25.8763 | 0.0144 |
| 7 | " ..... | 43-48 | 25.8615 | 25.8723 | 0.0108 |
| 8 | " ..... | 68-72 | 25.8605 | 25.8703 | 0.0098 |
| 9 | " ..... | 95 | 25.8308 | 25.8460 | 0.0152 |
| 10 | Diffused light..... | 41 | 25.8695 | 25.8700 | 0.0005 |
| 11 | " " ..... | 59 | 25.8632 | 25.8655 | 0.0023 |
| 12 | " " ..... | 59 | 25.8627 | 25.8643 | 0.0016 |
| 13 | Leaf in darkness.... | 41 | 25.8667 | 25.8688 | 0.0021 |
| 14 | Whole plant in darkness..... | 61 | 25.8615 | 25.8615 | 0.0000 |
| 15 | Whole plant in darkness..... | 61 | 25.8615 | 25.8619 | 0.0004 |
| 16 | Sunshine..... | 93 | 20.4408 | 20.5036 | 0.0628 |
| 17 | Darkness..... | 95-97 | 20.4402 | 20.4420 | 0.0018 |

A careful study of the foregoing table shows that the leaf invariably lost more water in sunshine than in darkness. The question now arises whether it is the light, or some accompaniment of it which in these experiments produced the evaporation. If the light, it must be through some vital activity of the plant, for light itself can not directly promote ordinary physical evaporation. We here come squarely upon one of the questions in dispute among vegetable physiologists, one party holding that the evaporation from plants is a purely physical phenomenon, exactly like the evaporation from any other moist substance, the other, including Dehérain, that it is different from ordinary evaporation in that the vitality of the plant controls it; or in other words, the two views may be expressed by saying that on the one hand it is regarded as a *physical* action, and on the other as a *vital* one.

A pine splinter from a board was now cut into about the size and form of a grass leaf, and after being soaked in water until

saturated, it was fastened into a cork exactly as the grass blade had been, and a number of observations were made upon it to see whether it would respond to the changes in light as the grass leaf had. The results are given in the table below:

| | Light. | Temperature. | Weight of empty tube. | Weight of tube after ½ hour. | Increase (= water evaporated). |
|---|---|---|---|---|---|
| 1 | Sunshine ..... | 63–68 | 20.4437 | 20.4717 | 0.0280 |
| 2 | " ..... | 90 | 20.4418 | 20.5120 | 0.0602 |
| 3 | Darkness ..... | 97–74 | 20.4418 | 20.4450 | 0.0032 |
| 4 | " ..... | 109 | 20.4430 | 20.4480 | 0.0050 |
| 5 | " ..... | 61–97 | 20.4425 | 20.4439 | 0.0014 |
| 6 | " ..... | 99–120 | 20.4422 | 20.4471 | 0.0049 |

Here we had, without doubt, a purely physical action, and yet the evaporation was about ten times as great in light as in darkness. Now, light itself could not have been the cause of this increased evaporation in this case, and it is a just inference that it was no more the cause in the previous experiments upon the leaf.—*C. E. Bessey.*

THE FLORA OF ARKANSAS.—From the geological formations, varied surface features and central geographical position of Arkansas, one would expect to find a flora rich in genera and species.

The State embraces Silurian, Sub-carboniferous, Cretaceous, Tertiary and Quaternary formations. The surface comprises mountains, uplands, prairies, alluvial bottoms and swamps.

Geographically it is so situated as to invite the floras of the States on the north-east, south and west, and also has a flora of its own.

These important elements, favoring plant occurrence and distribution, combine to make the botany of Arkansas interesting, and the species numerous and varied. A few instances will serve to show the richness of the flora of Arkansas as compared with that of Iowa, which lies on the same side of the Mississippi river, but some degrees further north.

There are 34 species of the order Rosaceæ in Iowa, while the order is represented in Arkansas by 35 species. There are 208 species of Compositæ in Arkansas and only 156 in Iowa; 18 species of the genus Quercus in Arkansas, only 10 in Iowa; 110 species of grasses in Arkansas, only 90 in Iowa. The genus Carya is represented in Arkansas by all the 8 species found in the United States, while only 4 are recorded from Iowa.

The flora of Arkansas is represented by all the orders found in Iowa and in addition by Magnoliaceæ, Droseraceæ, Calycanthaceæ, Melastomaceæ, Loasaceæ, Passifloraceæ, Hamamelaceæ, Aquifoliaceæ, Styraceæ, Loranthaceæ, Saururaceæ, Ceratophyllaceæ, Myricaceæ, Palmæ, Hæmodoraceæ and Bromeliaceæ.

The most of the species found in the adjoining States east of the Mississippi, are also found in Arkansas. The same may be said of the flora of East Texas, Indian Territory and Kansas.

I will close by giving a few of the trees of the gulf and coast flora that are found in South Arkansas, viz: *Magnolia glauca* L., *Sapindus marginatus* Willd., *Nyssa uniflora* Wang., *Fraxinus platycarpa* Michx., *Olea Americana* L., *Persea Carolinensis* Nees, *Carya myristicæformis* Nutt., *Quercus aquatica* Nutt., *Q. Phellos*, L., and *Pinus Tæda* L.—*F. L. Harvey, Ark. Ind. Univ., Jan. 13, 1881.*

Botanical Notes.—M. E. Jones, of Salt Lake City, well known as a collector of western plants, has recently sent out a printed list of his second fascicle of Utah plants. It includes about four hundred and fifty species, many of which are rare and interesting.——Grawitz has recently shown that the moulds Eurotium and Aspergillus possess forms which are highly malignant when they obtain access to the circulatory system of animals. Their spores germinate in the veins and arteries and are carried to various parts of the body, producing death within a few days. The other forms of these fungi do not exhibit this malignity.—— In a paper on the preservation of grain in closed vessels, presented to the Paris Academy of Sciences, Jan. 10 and 17, 1881, Muntz announced that the production of $CO_2$ was but one-tenth as much in air-tight vessels, as when the air had free access. Increase of moisture and of temperature, increase the production of $CO_2$. The presence of $CO_2$, although indicating the physiological combination of the material of the grains, is in one sense beneficial, as the asphyxiating gas prevents the attacks of certain insects.—— Woronin has been studying the curious Myxomyceteous organism, known as *Plasmodiophora Brassicæ*, which is supposed to be the cause of the hernia of the cabbage.——Dr. Koch has shown, in Cohn's *Beiträge zur Biologie der Pflanzen*, that perfectly dry seeds can withstand a temperature as high as 120° to 125° Cent. (248° to 257° Fahr.), without injury——In the same publication Dr. Miflet details the results of the studies of the Bacteria in the air. The air from a sewer contained an abundance of germs; that from the soil contained a few, while that from a fever hospital contained none, because of the excellence of the ventilation.——Dr. Heilsher has shown (in Cohn's *Beiträge)* that one of the cotyledons of *Streptocarpus polyanthus* is persistent and develops into a perennial foliage leaf.——In *Nature* for Feb. 10, Mr. Francis Darwin reviews at length Dr. Herman Müller's recent work on the fertilization of Alpine flowers *(Alpenblumen, ihre Befruchtung durch Insekten und ihre Anpassungen an dieselben).*—— According to Baron Ferdinand von Müller, the blue-gum tree *(Eucalyptus globulus)* of Australia will endure a temperature as low as 20° or even 15° Fahr. It would appear from this that it might be grown in places in the Gulf States.——J. C. Arthur publishes

a valuable paper on "The various forms of Trichomes of *Echinocystis lobata*," in the March *Botanical Gazette*. It is accompanied by a plate with nine figures.——In the March *Torrey Bulletin*, J. B. Ellis hazards the belief that Coleosporium of Solidago (*Uredo Solidaginis* Schw.) is the rudimentary stage of the Dothidea (*Sphæria Solidaginis* Schw.) common somewhat later in the season on the same leaves.——In the same number a translation appears of Dr. Herpell's method of preparing the fleshy fungi for the herbarium. The essential features of the process are these: Stout sheets of paper are coated over with gelatine. The fungus is cut into thin longitudinal sections and these are laid upon a moistened sheet and afterwards placed in an ordinary press. Such preparations are said to retain their colors excellently.

## ZOÖLOGY.

NEW TEXAN UNIO.—The following description is based upon a series of shells received from the late Prof. Boll, of Dallas, Texas. They were collected by him in the last trip but one made in the interests of science. With them came a number of other Texan forms, perhaps all referable to described species and of great interest from the light they throw on geographical distribution, and the variations to which the Unionidæ are subject, dependent thereon. It is hoped to make them the subject of a future communication.

*Unio bollii* (sp. nov.).—Testa lævi, sub-rotunda, ventricosa, subinæquilaterali, postice obtuse angulata, antice rotunda; valvulis crassissimis, antice paulisper crassioribus, postice ad dorsum paulum tuberculatis; natibus subelevatis, tumidis, ad apices valde granulatis; epiderme pallido-lutea usque albofusca aut viridicante, eradiata; dentibus cardinalibus magnis, erectis, acuminatis crenulatisque; lateralibus sublongis, crassis rectisque; margarita alba et postice iridescente.

Shell smooth, rather rounded, inflated, somewhat inæquilateral, obtusely angular behind, rounded before; valves very thick, thicker before, behind on dorsal aspect very little tuberculated; beaks somewhat raised and swollen, much granulated at the tips; epidermis pale yellow to light brown, or greenish, without rays; cardinal teeth large, erect, acuminate and crenulate; lateral teeth rather long, thick and straight; nacre white and iridescent posteriorly. Diameter 1.5 in., length 2.75 in., breadth 3.12 in.

Habitat, Colorado river, Texas. J. Boll. My cabinet, and cabinet of Arthur F. Gray.

Shell smooth, rather rounded, inflated, somewhat inæquilateral, obtusely angular behind, rounded before; substance of shell very thick, thickened anteriorly, on dorsal aspect, posteriorly, a number of small tubercles with a tendency to arrangement in rows; beaks somewhat raised and tumid, much granulated at the tips; ligament long, thick, in color partaking of the general character

of the epidermis; the latter pale yellow to light brown, with a greenish cast, without rays, but with very marked darker concentric lines of growth moderately distant, umbonial slope rounded; posterior slope raised and broad, slightly sulcate near dorsal aspect, where are rather numerous small pustules; cardinal teeth heavy, erect, acuminate, crenulate, double in the right valve, with a third accessory small tooth in the sinus of the major divisions, single in the left valve with sinus corresponding to the small third tooth of the right valve; lateral teeth rather long, thick, crenulate and straight; anterior cicatrices distinct, deeply impressed, that of the adductor muscle especially so and extending very nearly to dorsal margin; posterior adductor cicatrix rather deeply impressed, confluent with posterior retractor impression, the latter above, deep, at extreme end of lateral teeth; dorsal cicatrices at unequal distances along the anterior aspect of the cavity of the beaks, the last near the *protractor pedis* impression; pallial impression deep for the anterior two-thirds of its length; cavity of the beaks deep and triangular; of the shell deep and rounded; nacre milky white and iridescent posteriorly.

*Observations.*—This is a very distinctly marked species, not easily confounded with any other Texan shell. It is, perhaps, allied to *U. quadrans* Lea, but differs in the following constant characters: It is not quadrate, has a much lighter epidermis, heavier teeth, the erect cardinal teeth, the tuberculated posterior slope, the shape and depth of the cavity of the beaks, and the distinct anterior cicatrices.

The species is dedicated to the late Professor Jacob Boll, in memory of his services to science, he having done not a little to foster a love for natural history in his adopted State of Texas.—*R. Ellsworth Call, Des Moines, Iowa.*

NOTE ON SUCCINEA CAMPESTRIS AND S. AUREA.—A gentleman residing in Illinois, recently sent me a number of land and marine shells for determination, collected in November, 1880, in the vicinity of New Orleans, Louisiana, and on the main-land of Florida and Cedar Keys. Among the land shells collected by him at New Orleans, was *Succinea campestris* Say. In Part I, of "Land and Fresh Water Shells of N. A.," published by the Smithsonian Institution in 1869, Mr. Binney assigns as the geographical range of this species the States of Florida and Georgia, remarking that it has been "observed as yet only" in those States. The specimens under consideration are, beyond doubt, *campestris*. Mr. Binney repeats the same remark in Vol. V of his recent "Terrestrial Air-breathing Mollusks," page 427, published in 1878, by the Museum of Comparative Zoölogy, as Vol. IV of its Bulletin. The species was sent me from Charleston, S. C., in the summer of 1877. These two localities will therefore extend its geographical limits both to the north and west. It will probably be found also at intermediate points in Mississippi and Alabama.

In both of the works quoted the distribution of *Succinea aurea* Lea, is limited to the State of Ohio. It is remarked by Mr. Binney, "a species of the interior region, but restricted as far as yet known to Ohio." There are, in my collection, specimens of this beautiful species from three separate localities in that State. But there are also specimens from the interior of New York, collected by me at Richfield Springs, Otsego county, in July, 1877. In the Bulletin of the Buffalo Society of Natural Sciences for August, 1874, is printed a paper on "Land and Fresh Water Shells of the State of New York," by the late Dr. James Lewis. On p. 133, he quotes *S. aurea* from Staten Island on the authority of S. Hubbard, but quotes it with a question mark, and in parenthesis, says, "Probably not authentic." He also quotes the species, on the authority of himself, from Little Lakes, with the remark, "Probably not clearly identified." The locality last named is but a few miles from Richfield Springs, and is in the same county. But, beyond a doubt, *S. aurea* does occur at both of those localities. The specimens collected by me thoroughly satisfied Dr. Lewis that *aurea* really belonged to the New York fauna. He so labeled some I gave him; and a recent very careful comparison with typical forms from Ohio affords conclusive proof of specific accuracy. The geographical limits of this last named species must, therefore, be greatly extended, and made to include Western and Central New York.

It might also be added to these new localities for well known shells, another locality for *Unio pressus* Lea. It was collected by me in the Des Moines river, in August, and in the Nishnabotna river, in the extreme south-west of Iowa, in September last. This species, therefore, ranges from Whitehall, in New York, to Fremont county, Iowa, and may be discovered yet farther west.—*R. Ellsworth Call, Des Moines, Iowa.*

The English Sparrow in Illinois.—In relation to the curious habit of the English sparrow reported by Mr. Gillman, in the February number of the Naturalist, attention is called to the following statement, translated from a little book on native German mammals and birds:[1]

"To begin with the spring, we must give especial prominence to the fact that the sparrow, at the very time when it engratiates itself with the gardener as a protector of his fruit trees, also enrages him by wantonly biting off the buds of the leaves and the blossoms. This mischief appears to us to be done chiefly as a pastime, for the bird carries the plucked bud for a long time here and there in its beak, and finally lets it fall.

"Whether the discovery of a worm in a bud * * * does not also, in many instances, induce the sparrow to extend its

[1] *Die einheimischen Säugethiere und Vögel, nach ihren Nutzen und Schaden in der Land und Forstwirthschaft.* Von Adolf und Karl Muller. Leipzig, 1873.

search to the soundest buds, is a question which we will not attempt to decide."

The thorough examination of the food and food habits of the English sparrow which is certain to result from the intense and universal interest the little stranger has awakened, will give us a mass of valuable facts for comparison with those accumulated in Europe, where the debate concerning the good and evil of its life has been vigorous and long-continued. We shall thus be able to trace much more fully and exactly, than has ever yet been done, the effects of widely changed conditions upon the alimentary regimen of a bird.

Now that the stage of more or less ignorant and passionate discussions and personal vituperation seems nearly to have passed, contributions of fact will probably not be unwelcome. I add a few notes on the food of twenty-five birds shot in and around Aurora, Ill., in September, of two successive years, 1879 and 1880.

The elements of the food at this time were quite few and simple, consisting almost wholly of fragments of grain picked up on the streets and of the seeds of a few of the commonest grasses. At a time when thirty per cent. of the food of the robin, twenty per cent. of that of the catbird, and ninety per cent. of that of the blue bird consisted of insects, no insects were found in the stomachs of these birds except traces of three grasshoppers, making perhaps six per cent. of the food. Fragments of corn, wheat and oats amounted to about forty per cent., and the seeds of grasses to as much more. The common pigeon grass *(Setaria viridis)* was much the most abundant species; but *S. glauca* and *Panicum sanguineum* occurred quite frequently, and three or four species of Panicum and Eragrostis, which I did not determine, were also present in small quantity. One bird had eaten many hemp seeds, five had taken a very few seeds of "smartweed" (Polygonum), and two had eaten little else than the seeds of the common garden sunflower.—*S. A. Forbes, Normal, Ill.*

The Red-winged Starlings generally leave this region before we have any severely cold weather. After the breeding season is over they congregate in vast flocks, which sometimes almost darken the air. They used to eat our corn in the fields to a damaging extent, but for several years I have heard no complaints on this score. It would seem that they are gradually abandoning this habit, possibly from having found some other supply of food. It used to be customary for the farmers to complain of their depredations and often shoot them. One enterprising legislator even tried to get a law passed, offering a bounty for their wholesale destruction. But better sense prevailed with the majority of the members. During the third week of last December I noticed about a dozen of these birds, which from some cause or other had remained with us. Below a neighboring mill dam the water flowed out, making a small brook. These birds were wading about in the

shallow water, apparently in search of something for food. When any one approached too closely they flew into the tree-tops near by, returning as soon as they were left unmolested. They continued this unusual habit for a week or more, but finally left us a few days before Christmas.—*Charles Aldrich, Webster City, Iowa, Jan. 7, 1881.*

THE INDIGO BIRD.—Writers on the ornithology of this section seem to convey the idea that this beautiful little bird *(Cyanospiza cyanea* Baird) is not common here. I think this is an error. I have frequently seen them in spring and early summer, and while I have never looked for their nests, I have had no doubt that they breed in the thickets and groves along Boone river. I used to see one quite often, which appeared to me to be a little trifle lighter in color than those generally met with. The blue was paler. I have seen him and heard him sing for several days in succession, and as I observed his peculiarity of color, there could be little doubt regarding his identity as one and the same bird. This was on the border of a crab-apple and hazel brush thicket, and the nest would no doubt have been found by searching for it. I see them so often about the time of breeding that I have never doubted that this region may be set down as one of their regular habitats.—*Charles Aldrich, Webster City, Iowa, 1881.*

ZOOLOGICAL NOTES.—The process of self-division in *Euglypha alveolata*, a flagellata infusorian, has been observed and illustrated by Dr. August Gruber.——A very large ascidian *(Ciona ocellata* Agassiz) has been discovered by Professor Verrill in abundance on the rocks and wharves at Newport, R. I. It is our largest and most elegant ascidian, but rare and very local in its distribution. It will be remembered that the European *Littorina littorea* was introduced on the shores of Maine, about 1868, but at a much earlier date on the shores of Nova Scotia. During the winter of 1879–80, it was found by Professor S. I. Smith, of New Haven. Two other littoral species of European shells, not before recorded as American *(Truncatella truncatula* and *Assiminia grayana)*, were found by Professor Verrill at high water, among the docks at Newport.—— Professor Semper's book, entitled The Natural Conditions of Existence as they affect animal life, has been published and will deserve a wide circulation. It is favorably reviewed in *Nature*, by Professor Ray Lankester, who, however, finds fault with the orthodoxy of Semper's Darwinism. It is evident that we are to have sects and sectarianism among evolutionists. We had supposed that Mr.Darwin had modified his own Darwinism, certainly among evolutionists Darwinism, as such, is being replaced by a modern type of Lamarckianism, as in our opinion it should be.——A Hymenopterous parasite has been hatched from larvæ found on two spiders (Linyphia); the larvæ were apodous and adhered to the abdomen of the spider, which, when full-grown, they fully equaled in size. ——The embryology of Selachians (Acanthias) has been recently

studied by Dr. H. Rabl-Rückhard, of the Berlin Museum, with a view (1) to determine the cephalic ending of the notochord in its relations towards the hypophysis cerebri and the so-called middle trabecula, and (2) the origin of the pineal gland. He finds that at no period has the embryo of Acanthias a notochord with its apex projecting beyond that part of the base of the skull, which subsequently becomes the dorsum sellæ, thus confirming the views of W. Müller, Balfour and Parker; though this view is not irreconcilable with the view of Reichert, that the notochord of young sharks at a certain period of development reaches to the frontal wall. ——As regards the comparison of the brains of the higher vertebrates with the lower, which is in controversy, by ascertaining the true position of the pineal gland, we advance towards a true solution of the difficulty. Rabl-Rückhard confirms the views of Balfour and Ehlers that in sharks this gland is developed just as in higher vertebrates, as Stieda insists, in all higher adult vertebrates it lies dorsally between structures which correspond to the primary first and second cerebral vesicles.—— Professor His, studying the question as to the development of a tail in the human embryo, disputes that it has at first a true tail, as it possesses no supernumerary vertebræ, and in pathology no extra number have ever occurred.

## ENTOMOLOGY.[1]

EXUVIATION IN FLIGHT.—Mr. R. McLachlan has recorded a remarkably numerous flight of the Ephemerid, *Oligoneura rhenana*, last August, at Basle, Switzerland, with the interesting observation that it casts the subimaginal skin while on the wing. We have often met with just such swarms of Ephemerids as Mr. McLachlan describes, flying either against the wind or against the current of a river. In the case of *Polymitarcys alba* (Say), which is extremely common on the Red river of the north, where in August, 1877, we found it actually giving the river a white appearance, and falling upon vessels like snow, the subimaginal skin was shed in an incredibly short space of time (less than a minute), but was almost invariably preceded by a brief period of rest. The impatience to fly off after the true wings were withdrawn, however, was such that in the large majority of cases the insect took wing before the subimaginal skin was fully cast, in which case exuviation would be completed on the wing. We cannot conceive of the beginning of the process taking place on the wing, for there is a period, however short, from the bursting of the skin on the thorax to the extraction of the wings from their covering, when the use of the wing, it seems to us, is impossible; and we can conceive of full exuviation in the air only on the hypothesis that the insect during the process descends from a sufficient altitude to afford time for the extraction of the new wings.

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

ON SOME NEW TUBE-CONSTRUCTING SPIDERS.—While wandering on a bright October day in search of spiders, over the hills on the Virginian shore of the Potomac, near the Aqueduct bridge, I noticed on a grassy place at the border of a pine wood, several small, nest-like structures with a round hole in the center, and was at once aware that I had at last before me the so-long looked for home of a certain ground spider or Lycosa.

FIG. 1.—Nest of *Tarentula nidifex* (Marx del.).

These little nests were about 2 cm. high, composed of bits of grass, little sticks of wood, pine leaves and rootlets, perfectly round and made in very much the same way as an ordinary bird's nest, and of much the same form (Fig. 1). The nest inside was cylindrical and about 2 cm. in diameter.

Removing carefully the little nest, I dug open the shaft and found it to be in some instances 10, in others 12 cm. deep, perfectly round, smooth, perpendicular and without any web lining. But the nest was strengthened inside by a lining, which resembled a very fine tissue paper, so fine that it could hardly be noticed. Under the lens it showed no threads but a more hardened texture, like varnish. This lining holds together the loosely arranged material and enables it to resist rainstorms, floods, snow and all dangers of a stormy winter, for I found several pretty well preserved ones in spring.

At the bottom of this shaft there laid in an unconscious or torpid condition, a large dark-brown spider (Fig. 2) in a semi-erect position. Pulling the spider out with my forceps, it awoke, made some movements and laid down again. I found five additional specimens, and the nests, as well as the shafts, were all constructed on the same plan. In only one instance did I find the bottom part somewhat enlarged.

FIG. 2.—*Tarentula nidifex* ♀ (Marx del.).

Not far away from the place where the above nests occurred, but upon a barren clay ravine, where the rain had washed away all vegetation, I found an apparently newly built structure, which differed from the former ones in the kind of the material used for its construction, for it was built of clay, little stones and few and

stronger wooden sticks (Fig. 3). On one side a little colony of lichens was flourishing.

In this shaft, which was wider than the others, I found a very large specimen of the same species. Handling it somewhat carelessly, it awoke, and turning quick around, caught my finger and bit it with such force, that it clung on my raised hand. The pain was intense and about as acute as that from the sting of a wasp, but it disappeared in twenty minutes, while the swelling of the finger and of half the hand, lasted over two hours.

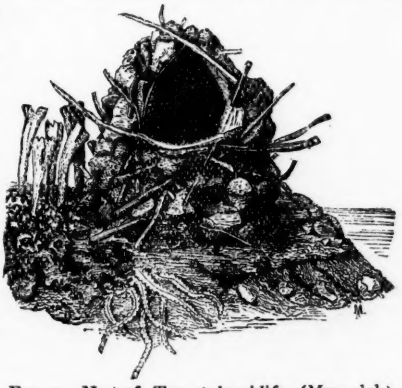

FIG. 3.—Nest of *Tarentula nidifex* (Marx del.).

I brought the spider home and filled a high glass jar three-fourths full of earth, and put the spider in its new home. It laid motionless on the ground, and I thought it was dead, but the next morning I found that it had dug, during the night, a hole 5 mm. deep, which it occupied. The following nights it deepened the shaft more and more until the depth was 12 cm. I strewed little sticks of broomcorn over the ground, and during the night it had placed a few sticks around the hole. Every morning it had added a few sticks, and at the end of the week the nest was complete, measuring 3.5 cm. in height. All her work was performed during the night, and in day time she occupied her new habitation. As it was too early in the season for flies, the poor creature had to fast for three months, during which time she kept herself confined in the shaft. Only when I placed the jar near the stove and the contents got warm, did the spider appear on the top of the nest and rest there, with legs bent under like a cat in the sunshine.

In March I caught the first fly, which was devoured in an instant by the spider outside the habitation. I then fed her regularly with flies, and she would jump up after them. Did the fly come near her she stood erect upon her four posterior legs, and with the four anterior and her palpi, she made rapid sweeping motions towards her mouth, and she got the fly always. One day I placed a watch glass full of water on the ground, and the spider at once made use of it by placing her palpi and front feet in the miniature basin, and then drawing them through her mandibles several times. At last she waded into the basin, where she lay for a quarter of an hour, the whole body except the head being under water. One morning, May 26, I found her dead in the

water. The specie seems to be new, and I have called it in MS. *Tarentula nidifex.*

About the same time I received from Mr. Nicolas Pike, of Brooklyn, with whom I had corresponded upon this subject, specimens, in a dried state, of a Lycosa which, according to a statement of this eminent naturalist, digs similar holes in the sand near the sea shore. Mr. Pike speaks thus about the habits of this remarkable spider, to which I have given the MS. name of *Tarentula pikei:*

It makes a hole in the sand from 12 to 15 inches deep (in one instance I found it 22 to 23 inches), perfectly perpendicular, and the depth and diameter vary according to the size and age of the individual. The entrance to the habitation is neatly underwoven with a fine web and particles of sand, which extend down more than an inch from the entrance, where the excavation widens so as to enable the spider to turn more rapidly and retire to the bottom with its prey. The lower part is also enlarged, and is covered as well as the whole length of the tube, with a substance which the spider secretes and which forms a hard, smooth finish to the interior, so that when it runs in and out of the tube not a particle of sand is displaced.

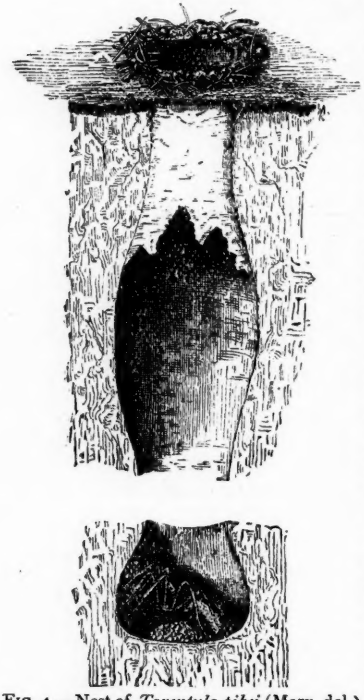

FIG. 4.—Nest of *Tarentula pikei* (Marx del.)

The entrance to the excavation, when inhabited by adults and built on an elevated sand dune, is very neatly thatched with pieces of fiber and the fine grass which abounds on the seashore (see Fig. 4). This thatched entrance is ingeniously constructed, and sometimes, not always, interwoven with a fine web, which prevents the loose sand from falling into the hole.

It was some time before I could ascertain the manner in which these spiders construct their curious habitations, as the work is always carried on at night. At last my perseverance was rewarded.

In the summer of 1877 I passed some time at Shinnicook and its vicinity (Long Island). While encamping in a very remote and out of the way place, amongst the sand dunes, where these spiders are numerous, I there had the good fortune to see the operation of building as well as to study the habits of this probably hitherto undescribed spider. In this case a female was the operator. She commenced by removing the sand on the surface till a saucer-shaped excavation was made, about a quarter of an inch deep. This was done by pushing away the sand with her body, and then she commenced to make the excavation proper, with a peculiar rotary movement of her body. The sand was pushed back and a glutinous web was spun, which held back the particles of sand, she at the same time pressing it with her abdomen to the size required until the opening was completed. I could still observe her at work as she constructed the upper chamber (if I may call it so), which occupied much time. After this was finished, I lost sight of her, as the excavation in the damp sand was raised. My obser-

vations were made by the dim light of a lantern, as the night was dark and cloudy. It was midnight when I left her and laid down in my rubber blanket, and at dawn the next morning the nest was finished. She had completed it by a thatched ring one and a half inch in diameter. I reluctantly destroyed the nest, but was anxious to examine all its parts. I first tried to get the spider out by inserting a straw, but she would not move. I then carefully removed the thatch and web for preservation, and then dug down to ascertain the depth and structure of the excavation. I found it to be 21½ inches deep, perfectly straight down, and the upper and lower chambers were just twice the size of the main tube, which in this case was seven-tenths of an inch in diameter. There was not a vestige of web, except in the two chambers, as the sand was damp and adhesive.

In the month of June I have found the female on her eggs at the bottom of the tube; these were loosely covered with web and agglutinated sand, similar to the egg bag of the *Lycosa maritima* Hentz. She seldom leaves her eggs, but remains with them till they are hatched, when the young cling to her body till they are about three-eighths of an inch long.

FIG. 5.—*Tarentula pikei* ♂ (Marx del.).

Fig. 5 represents the male, and Fig. 6 the female of this interesting species.

Mr. S. H. Scudder has published in *Psyche* (January, 1877) an account of a tube-constructing ground-spider which dwells in the sandy spots and dunes of Nantucket, and which he calls *Lycosa arenicola.* While the habits differ from those of *Tarentula pikei* (for instance, the shaft is without the widenings in the upper half and at the bottom) and the two species differ in some respect in form and color, they certainly belong to the same genus and are nearly related.

Another mention is made of a spider which makes similar habitations, by that gifted observer, Mrs. M. Treat, of Vineland, N. J., who in *Harper's Monthly* (April, 1880) describes at length its habits, and names the species *Lycosa turricola.*[1]

FIG. 6.—*Tarentula pikei* ♀ (Marx del.).

In conclusion I will state a few facts about the habits of the spider *(T. nidifex)* which I have found, in which it differs from the other three species here mentioned, viz: *T. pikei*, *L. turricola* and *L. arenicola.*

While the discoverers of these three species are unanimous in stating that they have found egg-bags at the bottom of the tubes, I have never found any egg-bag, although I have opened more than twenty tubes in spring and summer. Nor have I noticed any indication that the spider uses this subterranean structure as a home during the time she has to care for her eggs or young ones. On the contrary, I am convinced, for the following reasons, that this species (*Nidifex*) uses this structure only as a safe and secure winter

[1] See also an article "The Lycosa at Home," by J. H. Emerton, in the NATURALIST, Vol. IV, p. 664.—EDITORS NATURALIST.

quarter, and that during the warm spring, summer and early autumn months she lives on the surface:

1. Only during the latter part of October and fore part of November, have I found the newly built nest and chimney-like structures.

2. I always found then, in each shaft, one spider in its winter sleep.

3. In May the structures above ground were, if still existing, in a dilapidated condition, and the shafts unoccupied.

4. In June, July and August, I have never found a single spider "at home," the above ground buildings were in the same unrepaired and dilapidated state.

5. During these months I have found by sweeping the grass and low bushes, three specimens of the spider, and one in an old stump of a sycamore, where she had constructed a web.

As this spider lives in a cultivated place, *i. e.*, grass bottom with shrubbery and trees in abundance near by, she finds her prey outside her shaft, and at the same time, ample opportunity to hide from her enemies under moss, leaves or stones, etc., while *T. pikei* and *L. arenicola*, living without any shelter on the barren sand dunes, are compelled, for safety sake to occupy their under-ground habitations permanently.

*Lycosa turricola* builds her nest, according to the statement of

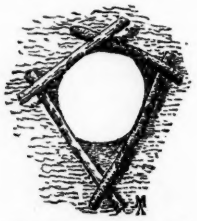

FIG. 7.—Entrance to nest of *T. nidifex*.

FIG. 8.—Entrance to nest of *T. nidifex*.

Mrs. Treat, upon a pentagonal plan. Now *Tarentula nidifex* uses for constructing her nest a displaced quadrangle or rhomboid (see Fig. 7). When the material for the nest consists of soft and flexible grass blades, the spider bends them round the hole half way (see Fig. 8), but if she uses coarser sticks, she lays them always as is shown in Fig. 7, but if she finds a piece naturally bent, she makes use of the curve by laying it so that the concave side is brought around the hole.—*Geo. Marx, Washington, D. C.*

THE RASCAL LEAF-CRUMPLER IN GEORGIA.—We have received from Mr. J. P. Henderson, Commissioner of Agriculture of Georgia, specimens of this insect (*Acrobasis nebulo* Walsh) reported as doing great injury to the orchards of Mr. James Speir, in Bryan Co., of that State, webbing together the leaves and eating out the buds as they put forth in the spring. Its injuries in the Western States have long been well known, but its appearance in the South has not been so generally recorded.

VERTICAL VS. HORIZONTAL INSECT BOXES.—A. Preudhomme de Borre has published a pamphlet on the "Best arrangement of boxes and cartons of collections of insects." While admitting that as far as space and convenience are concerned, the arrangement of boxes on their edges is advantageous, he claims that for the following reasons it is unwise, viz: (1) Specimens become loose and fall, breaking themselves and their neighbors; (2) or they turn on their pins with similar results; (3) infected specimens are not readily detected by the dust.

Dr. G. H. Horn, of Philadelphia, claims that the objections urged by M. de Borre are due, in a great measure, to the improper boxes used for preserving specimens in France and Belgium, and makes the following arguments against de Borre's objections:

1. The French boxes are made of thick pasteboard, having false bottoms made of *papier maché*, or peat, very rarely of cork. The paste-board is objectionable from the fact of its tendency to lose its shape and become convex, while the peat and *papier maché*, on account of their inelasticity, are unsuitable, the former having the additional bad quality of corroding and adhering to the pins.

2. The danger of the specimens becoming loose may be averted by using shorter pins than the French are accustomed to, and the bottom of the box should be invariably lined with cork of at least one-fourth of an inch in thickness. To prevent the specimen from turning on the pin, dip the pin previously into an alcoholic solution of shellac. In the case of large specimens, slightly flatten the pin by a few blows with a hammer, in addition to coating it with shellac.

3. The presence of infection is readily detected in a vertical box as the dust always falls on the head of the specimen below the infected one.

4. The box for the preservation of specimens should be made of well seasoned pine, nine by fourteen inches and two inches deep, all outside measure. The lining of the bottom should be cork of one-fourth of an inch in thickness, covered with thin glazed paper. In such boxes, specimens may be arranged in the following manner: draw faint pencil lines from one side of the box to the other, dividing it into five or six equal portions, according to the size of the specimens, then beginning at the upper left corner of the box, place four specimens side by side, and so on down that column, and then the other divisions in succession.

INSECTS AFFECTING THE CHINA TREE.—The China tree *(Melia azedarach)* has always been considered as perfectly free from any insect attacks whatever. No caterpillar of any kind has ever been found feeding on its foliage; no Buprestid or Scolytid beetles bore in its trunk or branches, and no gall-insects disfigure its leaves or twigs. This tree, with its beautiful dense foliage, is, in fact, to be highly recommended as a shade tree in the South, and especially in those cities which are so badly infested with the

Bag-worm *(Thyridopteryx ephemeræformis)*. This immunity enjoyed by the China tree from the attacks of insects, is not perfect, however, as we have recently received from Alabama some twigs and leaves infested with the scales of a Coccid belonging to the genus Lecanium; but what is more interesting, the twigs are covered with the waxy scales of a Ceroplastes of really beautiful appearance and new to science. The leaf-cutting ant *(Atta fervens)* shows a decided partiality for the leaves of this tree in Texas.

GALLS ON EUCALYPTUS.—Mr. R. McLachlan has recently described two very interesting galls occurring on *Eucalyptus gracilis* in Australia; the one a curious modification of a flower bud and possibly Cecidomyidous, the other occurring on the leaf-stem and looking like a capsule with three or four long arms, and supposed to be Lepidopterous. We know of no Lepidopterous galls that take on any such specialized characters as the last named, figured by Mr. McLachlan, the galls made by this Order of insects being almost invariably mere swellings of a stem, a fact which would indicate that the Lepidopterous larva which Mr. McLachlan found in this Eucalyptus gall might be inquilinous.

NORTH AMERICAN ANTHOMYIADÆ.—Dr. Hagen publishes in the March number of the *Canadian Entomologist*, a list of the North American species of this family of flies, contained in the Cambridge Museum, and which have been examined by Mr. R. H. Meade of England. In Osten Sacken's Catalogue there are 139 species given, including a number of Mr. Walker's, which seem not to have been yet identified. Mr. Meade makes out 121 species, and Dr. Hagen states that Loew's collection contains 12 not seen by Mr. Meade, so that the whole number of North American species, represented in the Cambridge Museum, is 133, of which 34 seem to be identical with European species. The *Anthomyia angustifrons* Meig., of the First Report of the United States Entomological Commission, which so commonly infests, in the larva state, the egg masses of *Caloptenus spretus*, is referred here as in Osten Sacken's catalogue to the genus *Chortophila* Macq.

GALLS AND GALL-INSECTS.—We are pleased to see, that after some years of intermission, Mr. H. F. Bassett, of Waterbury, Conn., continues his descriptions of North American Cynipidæ. He describes in the above-named journal, several Californian species, among others *C. q. californica*, which attains the largest size, with perhaps one exception, of any hitherto known North American gall. The flies produced from it are all females, but the gall is interesting to the Coleopterist because it nourishes *Ozognathus cornutus* Lec., a beetle very curious from the fact that the male has a long, erect horn on the base of each mandible, the horns nearly meeting at their incurved tips. Mr. Bassett describes his galls from specimens collected in 1878 and 1880, at Red Wood city,

California, upon what he considers, with a question, *Quercus hindsii*. Our first specimens of this gall were received some ten years ago from Sonoma county, the oak not being determined, but we subsequently received specimens from San Mateo, Cal., from Dr. L. D. Morse, who is quite a good botanist, and who determined the oak as *Quercus douglasii*. We exhibited specimens of the gall to Mr. Bassett in 1871, and also presented some to Mr. Albert Müller, of Basle (then of England), who refers to it under our MSS. name of *Quercus-californica* in the Proceedings of the London Entomological Society for 1872, p. 32.

Aside from the various parasites which prey upon the Cynips, we have always found these galls to be infested with the beetle[1] above mentioned. Mr. Müller gives an account of his observations on the habits of this insect, showing that it agrees therein with *Anobium*. We would further remark that the beetle breeds in the dry galls and still continues its work in galls that have been in our cabinet over five years.

## ANTHROPOLOGY.[2]

THE PEOPLE OF ALASKA.—A very important document to the ethnologist is the preliminary report of Mr. Ivan Petroff to General Walker, upon the Population and Resources of Alaska, forming executive document No. 40, 46th Congress, 3d Session. The author was sent out by General Walker last year for this special service, for which he is peculiarly fitted by his thorough knowledge of both Russian and English. In the prosecution of his labors he traveled 4500 miles by steamer, 2500 by canoe, 1700 by sailing vessel; a total distance of 8700 miles. Our entire Alaskan country as far north as the Yukon was examined, and tabulated reports are given, village by village, of the inhabitants. The people of the Territory may be divided as follows: 1. The Innuit or Eskimo race, which predominates in numbers and covers the littoral margin of all Alaska, from the British boundary on the Arctic to Norton sound, of the Lower Yukon and Kuskokvim, Bristol bay, the Alaskan peninsula, and Kodiak island, mixing in, also, at Prince William sound. 2. The Indians proper, spread over the vast interior in the north, reaching down to the seaboard at Cook's inlet and the mouth of Copper river, and lining the coast from Mount Saint Elias southward to the boundary, and peopling Alexander Archipelago. 3. Least in numbers but first in importance, the Aleutian race, extending from the Shumagin islands westward to Atto—the *ultima Thule* of this country. The grand total of population is: whites, 392; Creoles, 1683; Aleuts, 2214; Innuits of Kodiak, 2196, of Togiak, 1826, of Bristol bay 2099, of Kuskokvim, 3505, of Yukon, 3359, of Behring sea, 1533, of the

[1] *Anobium cornutum* Lec., Proc. Phila. Acad., 1859, p. 87. Subsequently made the type of a new genus, *Ozognathus*, ibid., 1865, p. 226.

[2] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

Arctic coast, 2990; Indians 8401—total 30,178. The appearance and habits of the natives are also described, and a map gives the locality of all the places mentioned. The writer is exceedingly happy in his style, and the student will be agreeably disappointed who expects to find in this report a mere mass of arid details.

LANDA'S ALPHABET.—The story of the Abbé Brasseur de Bourbourg and his discovery of the Landa alphabet in the archives of the Royal Academy of Madrid in a manuscript entitled "Relacion de las Cosas de Yucatan," has been told again and again. Nothing daunted by these frequent repetitions, Mr. Philipp Valentini, the learned Mexicologist, advances to the front in a paper published in the April number of the *Am. Antiquarian* for 1880. We had occasion to speak of the judicious treatment of this subject by Professor Rau in his Palenque Tablet volume. Professor Valentini sets out with the assumption that the alphabet is a Spanish fabrication, that the Central American hieroglyphics stood for objects and nothing else, and that the believers in this alphabetic table were laboring under a delusion. The literature of the Conquest, particularly the Mendoza codex, is invoked in confirmation of this view. Coming to Bishop Landa himself, Mr. Valentini first examines his text and rejects it as insufficient; the remainder of the paper is devoted to the alphabet. Its genuineness is questioned on the following grounds: 1. The number of letters does not agree with that of the Maya sounds; 2. The succession is the same as in the English Alphabet, though this is allowed to be not improbable; 3. There are various characters for the letters *a*, *b*, *l*, *o*, *p* and *u*; 4. Attention is called to the fact that though this may be *an* alphabet, it is not *the* Maya alphabet. Indeed, the presumed phonetic key represents nothing else than one of the various attempts made by the Spanish missionaries to teach their Yucatecan pupils how to write the prayers or any other text phonetically by means of symbols. In attempting to substantiate his position, and to interpret the glyphs, however, the author finds himself in the presence of abbreviated and conventionalized symbols without even the Mendoza codex to guide him. Notwithstanding, he plants his foot firmly upon the three following principles previously to making another step: All Central American hieroglyphics are either representations of (1) natural or (2) manufactured objects, or (3) they are symbols—objects conventionally chosen to represent some abstract idea. The twenty-seven letters of Landa are explained as follows: 1. a = *ac*, a turtle; 2. a = *ach*, obsidian knife; 3. a = *a*, the leg (in Quiche), 4. b = *be*, a path or footprint; 5. b, unexplained; 6. c = *tzec*, the fifth Maya month; 7. t = *te*, counting years, the sun; 8. é = *eek*, black; 9. h = *haab*, the year tied up; 10. unexplained; 11. ca = *caa*, to pull out hair; 12. k = *cimich*, death or skull; 13. unexplained; 14. l = *elel*, the pod of the oxalis; 15, 17, 18. unexplained; 16.

n = *ne*, tail; 19. p = *pek*, dog; 20. pp = *ppec*, stone; 21. *cum*, the guacal gourd; 22. ku = *kuk*, to bud like the cactus; 23. x = *chuy*, a bunch, as of bananas; 24. x = *xe*, to vomit; 25. 26. u = *uuc*, to bend, to wind; 27. z = *tzee*, to mash corn.

THE HISTORICAL SOCIETY OF WISCONSIN.—The 27th Annual Report of this society reminds us of the very great amount of good which can be accomplished with limited means. The report of the operations of the society touches anthropology at several points. There is a committee on Indian history and nomenclature, consisting of Messrs. Chapman, Butler, Conover, Durrie and Hutchison; another on prehistoric antiquities, to which belong, in addition to some of those above mentioned, Messrs. Perkins, Allen and Giles. Another committee is charged with collecting the history of the early settlements. The society is the trustee of the State collections, and holds all its present and future collections and property for the State.

AMERICA AND THE EAST.—In a paper reproduced in part from Mr. C. N. Holford in the *Kansas City Review* of Feb., is another of the many occurrences of what might be called the "double-corner" of archæology, from the game of checkers. We are in the presence of a vessel or a sculpture from Mexico which reminds one very much of the hoary civilization of Egypt. The interminable game begins between the assumption that similarity of technique demonstrates consanguinity, or at least contact; and that the human mind, being one, unfolds itself similarly under like environments.

HARVARD LIBRARY BULLETINS.—No. 17 of these publications gives a list of the more important accessions to the library during the past year. A goodly number of these are upon anthropology and are accredited to the Peabody Museum of Archæology.

ANTIQUITIES OF PERU.—A. Asher & Co., of Berlin, are preparing to publish in ten parts, folio, a magnificent work by W. Riess and A. Stübel, entitled "The Necropolis of Ancon in Peru: a series of Illustrations of the Civilization and Industry of the empire of the Incas, being the results of excavations made upon the spot." The edition in English is limited to 250 copies, 100 of which have been taken by Messrs. Dodd, Mead & Co., who have the exclusive sale of the work in America.

ANTHROPOLOGY IN FRANCE.—The October number of *Revue d'Anthropologie*, closing the third volume of the second series, is one of exceedingly great interest. The opening article by Dr. Pozzi, is an eulogy upon Dr. Paul Broca, the most distinguished French anthropologist, and the founder of the "Ecole d'Anthropologie," and the "Laboratoire d'Anthropologie," of Paris. Accompanying the sketch is a photograph of Dr. Broca, and a complete bibliography of his writings, pages 592–608, extending from 1847 to 1880, and embracing nearly five hundred titles. At

the close of the number, pages 722–738, will be found the funeral discourses by M. Eugène Pelletan, in the name of the Senate; M. Verneuil, for the Faculty of Medicine; M. Trélat, for the Academy of Medicine; M. Tillaux, for the Chirurgical Society; M. Dumont-Pallier, for the Biological Society; M. Gariel, for the French Association; M. Ploix, for the Society of Anthropology; and M. Henri Martin, on behalf of the Institute. Dr. Gavarret, formerly President of the Société d'Anthropologie, and at present Inspector-General of the Medical Schools of France and Professor in the Faculty of Medicine, at Paris, succeeds Dr. Broca as President of the School of Anthropology. The unaffected sorrow which has found expression in other anthropological societies and journals, besides those in his own country, is keenly felt on this side of the Atlantic by many who have delighted to sit at the feet of the deceased savant. Dr. Broca (born on the 28th of June, 1824—died, July 8–9, 1880), can scarcely be thought to have reached "the summit of his curve." Cut off in the midst of his arduous labors he has left a void in the heart of his pupils and colleagues which it will be impossible to fill.

Though somewhat overshadowed by the account of Dr. Broca, the remaining matter of the *Revue* is quite up to the standard. The original papers are: Etudes d'Anthropométrie sur les Canons Anthropologiques. 1. Du Tronc, by Paul Topinard, pp. 609–620; Les Negres ches eux, ou études ethnographiques sur les Populations de la Côte-d'Or (Côte occidentale d'Afrique), by M. A. T. Mondière, pp. 621–650 (to be continued); Excursion Anthropologique au Sahara (1880), by Dr. H. Weisgerber; pp. 651–668. Dr. Topinard criticises at length M. G. de Rialle's volume in the Bibliothéque Utile entitled, *Les peuples de l'Afrique et de l'Amerique*, published in Paris, 1880, by Balliere et Cie.

The number closes with a résumé of works on prehistory; climography of Algeria; Anthropological Journals of France, Italy, England and Germany; and a list of anthropic papers read at the French Association, p. 738.

Sepulchral Mounds and Costume in Japan.—In Vol. viii, Pt. iii, Translations of the Asiatic Society of Japan, pp. 313–332, will be found an important paper by Ernest Satow, upon ancient sepulchral mounds in Kaudzuki province. The author makes honorable mention of Professor Morse's important discoveries in the shell heaps of Omori and then proceeds to describe the burial-mounds. Two forms are mentioned, the circular tumuli, apparently for persons of inferior rank, and the double tumuli, from one of which was obtained a large collection of pottery, iron weapons, articles of bronze and blue glass beads. These twin mounds *Futa-go yama*, lie east and west, the west end being square, the eastern, round, and the middle, contracted. The east end contains the tomb, opening south, and is divided into three sections, the outer passage, the sacrificial chapel, and the vault.

Many of the stones forming the roof are very large. "Each mound seems to have been built up in three tiers, on the top of each of which was a fence formed of a row of terra cotta pipes about two feet high, connected by wooden poles or bamboo passed through holes about half way from the base. The paper is illustrated with forty-three figures, some of which resemble pueblo and central American specimens (Figs. 2–5), and a careful examination of them will well repay those who are engaged in the study of comparative archæology.

Equally interesting and valuable is Mr. Josiah Conder's paper in the same number, pp. 333–368, on the History of Japanese Costume, and we regret the want of space for an abstract.

ETHNOGRAPHY AND PHILOLOGY OF AMERICA.—As an appendix to H.W. Bates' "Central America, the West Indies and South America," London, 1878, 8vo, the ethnologist A. H. Keane, B. A., has published an article of one hundred and twenty-eight pages, entitled "Ethnography and Philology of America." In the introductory part the author shows considerable judgment and sound reasoning power, but the descriptive portion of the article contains so many defects, that we cannot recommend it without reserve to students of ethnography and linguistics, in spite of all the industrious study which evidently was bestowed on it. The great mistake made by Keane is that of introducing simultaneously a linguistic and a racial (or anthropologic) division of the American natives. What do the Utchees, f. i., have in common with the Cherokees, and these with the Natchez and Catawbas, all of which Keane classed into one group of "*Appalachian Races*"? Does, according to Keane, proximity of the *present* homes of a people prove racial affinity or similarity? The Tutĕlos are classed by him under the Iroquois stock, the Mandans are made a sub-tribe of the Minitari, and the Lower Creeks identified with the Seminoles. An *ethnologic* family of Klamath River Indians never existed in Northern California, and Keane's Lower Californians are simply Yuma Indians. Carr's linguistic division of the Pueblo Indians of New Mexico (p. 479) would be nearly correct, if Nos. 2, 3 and 4 were combined into one stock. For the tribes of the interior of Southern Mexico, of Nicaragua, of Costa Rica, of the Isthmus, of New Granada, not even an attempt of linguistic classification is made, although much material has been published recently on this interesting subject. In the alphabetical catalogue of tribes many typographic errors are noticeable. Besides these, we find the following: Aruaquis are mentioned separate from the Arawaks or "flour-eaters," the Andaicos from the Nandakoes (Texas), the Mollale from Mollalas and Molels, congeners of the Cayuses (Oregon). The Goajiros of Venezuela, who speak a language clearly akin to the Carib family, are made Dariens and classified with the Isthmian family. Among the tribes of the Guaicuru family of the Gran Chaco, on the Paraguay river, the important

Mocobi or Mbocobi tribe is not mentioned, but considered as forming, with the Toba and Abiponian dialect, a linguistic family separate from the Guaicuru. In this particular he has copied Balbi; but Balbi is formally contradicted by the Brazilian traveler Martius (*Beiträge* 1, pp. 232, 780), who gives the missionary Dobritzhofer as his authority. The Texan tribe of the Tonkaways is relegated into Florida, and the Piqua regarded as an extinct Algonkin tribe, while it continues to flourish at the present time as a clan of the Shawnees or Shawanoes.

For advancing our knowledge of American ethnology and linguistic topography, not much is to be gained by copying and extracting modern and ancient authors who have not personally seen the tribes of which they give accounts. The number of false and inaccurate statements in this respect is simply enormous, especially regarding Central and South America. Reliable information on all these subjects can only be expected from future expeditions, made by conscientious travelers into the imperfectly explored regions of both American continents.—*Alb. S. Gatschet.*

## GEOLOGY AND PALÆONTOLOGY.

DISCOVERY OF THE PREGLACIAL OUTLET OF THE BASIN OF LAKE ERIE INTO THAT OF LAKE ONTARIO.[1]—This is the subject of a lengthy paper recently read before the American Philosophical Society, of which Dr. Spencer gives the following summary:

1. The Niagara escarpment after skirting the southern shores of Lake Ontario, bends at nearly right angles in the neighborhood of Hamilton, at the western end of the lake; thence the trend is northward to Lake Huron. At the extreme western end of the lake this escarpment (at a height of about 500 feet) encloses a valley gradually narrowing to four miles, at the meredian of the western part of the city of Hamilton, where it suddenly closes to a width of a little more than two miles to form the western end of the Dundas valley (proper). This valley has its two sides nearly parallel and is bounded by vertical escarpments which are capped with a great thickness of Niagara limestone, but having the lower beds of the slopes composed of Medina shales. On its northern side the escarpment extends for six miles to Copetown, but westward of this village it is covered with drift, but it is not absent. On its southern side the steep slopes extend for less than four miles to Ancaster, where they abruptly end in a great deposit of drift, which there fills the valley to near its summit, but which is partly re-excavated by modern streams forming gorges from two to three hundred feet deep. To the north-eastward of Ancaster these gorges are cut down through drift to nearly the present lake-level. Westward of Ancaster, a basin occupying a hundred

[1] *Discovery of the Preglacial Outlet of the Basin of Lake Erie into that of Lake Ontario.* With Notes on the Origin of our Lower Great Lakes. By J. W. SPENCER, B.A.Sc., Ph.D., F.G.S., King's College, Windsor, N. S.

square miles, where the drift is found to a great depth, forms the western extension of the Dundas valley. With the north-western and western portions of this drift-filled area, the upper portions of the Grand river and Neith's creek were formerly connected. The Grand river from Brantford to Seneca runs near the southern boundary of this basin, then it enters the old valley which extends from Seneca to Cayuga, with a breadth of two miles, and a depth in modern times of seventy-five feet, having its bed but a few feet above Lake Erie. However, along the eastern margin of this valley, near Cayuga, we find that the rock is absent even to a depth below the surface of Lake Erie.

2. The Dundas valley and the country westward forms a portion of a great *river valley*, filled with drift. Along and near its present southern margin this drift has been penetrated to 227 feet below the surface of Lake Ontario, thus producing a *cañon* with a lateral depth of 743 feet, but with a computed depth in the middle of its course of about 1000 feet.

3. The Grand river, at four miles south of Galt, has, since the Ice age, left its ancient bed, which formerly connected with the Dundas valley, as did also Neith's creek, at Paris.

4. Lake Erie emptied by a buried channel, a few miles westward of the present mouth of the Grand river, and flowed for half a dozen miles near Cayuga, where it entered the present valley, and continued in its channel (reversed) to a place at a short distance westward of Seneca, whence it turned into the basin referred to above, receiving the upper waters of the Grand river and Neith's creek as tributaries, and then emptied into Lake Ontario by the Dundas valley. This channel was also deep enough to drain Lake Huron.

5. Throughout nearly the whole length of Lake Ontario, and at no great distance from its southern shore, there is a submerged escarpment (of the Hudson river formation), which in magnitude is comparable with the Niagara escarpment itself, now skirting the lake shore. It was along the foot of this escarpment that the river from the Dundas valley flowed (giving it its present form) to eastward of or near to Oswego, receiving many streams along its course.

6. The western portion of the Lake Erie basin, the south-western counties of Ontario, and the southern portion of the basin of Lake Huron formed one Preglacial plane, which is now covered with drift or water (or with both) to a depth varying from 50 to 100 feet, except in channels where the filling by drift is very great. A deep channel draining Lake Huron extended through this region, leaving the present lake near the Au Sable river, and entering the Erie basin, between Port Stanley and Vienna, at a known depth near its margin, of 200 feet, but at a probable depth in the center sufficiently great to drain Lake Huron.

7. The Preglacial valleys (now buried) of Ohio and Pennsylvania—for example, the Cuyahoga, Mahoning (reversed), and Allegheny (deflected)—formed tributaries to the great river flowing through the Erie basin and the Dundas valley.

8. The bays and inlets north of Lake Huron are true fiords in character, and are of aqueous origin.

9. The Great lakes owe their existence to sub-aërial and fluviatile agencies, being old valleys of erosion of great age, but with their outlets closed by drift. Glaciers did not excavate the lakes and had no important action in bringing about the present topography of the basins.

10. The old outlet of the Niagara river, by the valley of St. David's, was probably an interglacial channel.

THE IRON ORES OF SOUTHERN UTAH.—During the past summer, which I spent chiefly in Utah, I visited the deposit of crystalline iron ore of Iron county, in the southern part of the Territory. These ore beds have been long known and were to some extent utilized by the Mormons in their first advent, thirty years ago, but no satisfactory description of them has ever been published. As they constitute, perhaps, the most remarkable deposit of iron ore yet discovered on this continent, I have thought that some facts in regard to them might not be an unimportant addition to what is known of the economic resources of our country. The iron region referred to lies nearly three hundred miles directly south from Salt Lake city, and is situated in what is really the southern prolongation of the Wasatch mountains. The iron ores occur in the northern portion of a subordinate range, which attains its greatest height in Pine Valley mountain near Silver Reef. Thirty miles north of this point the ridge breaks down into a series of hills from one thousand to two thousand feet in height, which consist chiefly of gray fine-grained granite, with dykes and masses of trachyte and here and there outcrops of highly metamorphosed limestone. The ore beds form a series of protruding crests and masses set over an area about fifteen miles long in a north-east and south-west direction, and having a width of three to five miles. Within this belt the iron outcrops are very numerous and striking; perhaps one hundred distinct claims having already been located upon them, each one of which would make the fortune of a mining company if situated anywhere in the Mississippi valley or the Eastern States. The most impressive outcrops are in the vicinity of Iron springs, Oak springs and Iron city, of which localities the first and last mentioned are about twelve miles apart. Near Iron springs the *Big Blow-out*, as it is called, is a projecting mass of magnetic ore, which shows a length of perhaps a thousand feet by a width of five hundred, and rises in castellated crags one hundred feet or more above its base.

At Iron springs a still more striking exhibition is made by the Blair mine, which is a ragged crest of magnetite, black as jet,

formed by the upturned edge of the thickest of a series of sheets of ore, which rises like a ledge of bedded rock two or three hundred feet above the adjacent low lands. This outcrop is visible as a conspicuous black hill, at a distance of several miles. The connections between the ore bodies of this great iron belt are obscured by the *débris* from the easily decomposed trachyte and granite. It is evident, however, that for some miles the iron ore deposits are continuous or separated by very short intervals, as the outcrops occur within a stone's throw of each other, and the surface is everywhere strewed with blocks of rich magnetic ore, enough in themselves to supply all the furnaces of the country for years. It would seem that the iron forms a number of distinct and closely approximated belts, which are the outcrops of beds that stand nearly vertical, and go down into the earth like huge walls.

There is considerable diversity in the character of the ore, though it is about equally divided in quantity between hematite and magnetite. Some of the beds of both are exceedingly dense and compact, while others, though rich in iron, are soft and can be mined with the pick. Most of the ore is apparently very pure, containing a small amount of earthy matter and no foreign minerals. Some of the ledges, however, contain a large quantity of silica, the magnetite being mottled with white quartz; and one of the largest outcrops, though showing many millions of tons of ore apparently quite pure, is thickly set along certain zones, evidently strata of deposition, with crystals of apatite from a quarter to half an inch in diameter and two or three inches in length. At this location many of the fragments are highly magnetic, and lodestone as strong as any known can be obtained there in great abundance. A few rods from this great outcrop is another of equal dimensions, in which the magnetite is apparently quite free from all impurities, showing neither quartz nor apatite. Near by is another exposure, perhaps a continuation of the last, of which the mass is half magnetite and the other half fine-grained and dense hematite. Across a narrow valley from this group the hillside is covered with fallen fragments of a rich but soft and dark hematite, and at no great distance the soil is colored blood-red by the decomposition of a hematite so soft as to make no other show above the surface. Near this latter location I noticed a line of outcrop of a very jaspery hematite, in some places only a ferruginous jasper closely resembling some of the more silicious ores of the Marquette district.

As to the age of this remarkable series of iron ore deposits, I cannot speak with absolute certainty, though they are apparently Lower Silurian.

The granite of the hills which contain the iron is finer grained and less compact than that which forms the great granitic axis of the Wasatch, and I suspect is the metamorphic condition of the

quartzite beds which rest upon the Wasatch granite. Some of the iron ore beds in this granite are distinctly interstratified with it, and are certainly, like it, metamorphosed sediments. This is plainly shown at the Blair mine, where the principal crest of the hill is a distinct sheet of stratified, regularly bedded magnetite, from thirty to forty feet in thickness, dipping toward the north at an angle of about eighty degrees. Parallel with this principal layer are other sheets of magnetite separated by strata of granite and varying from a quarter of an inch to ten feet in thickness, as perfectly parallel and regular as any series of sedimentary beds ever seen.

On the whole, the Blair mine is the most interesting and instructive outcrop of iron known to me, and furnishes the most striking proof of the sedimentary origin of these wonderful ore beds. None of the other outcrops are so distinctly stratified, but the Big Blow-out at Iron city affords an equally conclusive argument against the eruptive theory; for while it appears to be a huge amorphous mass, like a hill of basalt, on examination it is found to be in large part composed of metamorphosed limonite; that is, magnetite, which has the botryoidal and concretionary aspect and radiated structure of limonite, and was plainly deposited from water.

With the exception of the great iron deposits of Southern Utah, the far West is but imperfectly supplied with this metal. I have found magnetite and specular ores in small quantities in several places in the mountains of Oregon and California, and in the Rocky Mountain belt, and similar ores have been met with by prospectors and explorers in some of the districts which I have not visited. We have no evidence, however, that any other great deposits of iron exist in or beyond the Rocky mountains. If it is true, which I do not believe, that there are anywhere iron ores that are truly eruptive in character, it is somewhat surprising that in the immense area where igneous rocks predominate in the far West, no masses of eruptive iron ore have been met with. We have reports of eruptive masses of magnetite at Nijni Tagilsk, in Russia, and of hematite on the island of Elba, but no observations have lately been made for the purpose of determining whether these are what they have been reported to be. The famous beds of magnetic and specular ore of Sweden have also been considered, up to a recent date, as eruptive, but Professor Otto Torrell, Director of the Geological Survey of Sweden, with whom I was associated in the Centennial Exhibition, assured me that all the deposits of iron which he had visited in Sweden were metamorphic and not eruptive, and that he had no faith in erupted ores of iron.—*J. S. Newberry, in School of Mines Quarterly, Nov., 1880.*

Geological News.—A paper on the uniclinal structure of the Iberian peninsula, by J. Macpherson, is published in Spanish and English. A section of the rocks from the Mediter-

ranean to the Cantabrian coast is given.——Mr. Eugene Smith, State Geologist of Alabama, gives an account of the geology of Florida, in the April number of the *American Journal of Science and Arts.* He shows that the Vicksburg limestone occupies the center of the State, and that a small patch of earlier Miocene in the eastern center of the State, is the oldest formation within its limits. The everglades and coast regions are Postpliocene.——In the same journal Professor Marsh describes a new genus of Opisthocœlous saurians, which he calls *Cœlurus.* The vertebræ resemble those of *Camarasaurus,* but the walls are more attenuated, and the caudal centra are hollow. It is probable that *Amphicœlias fragillissimus* Cope, belongs to it. Professor Marsh proposes to regard the genus as the type of a new order, but gives no reasons for so doing.——The second annual report of the Bureau of Statistics and Geology of Indiana for 1880, under the direction of John Collett, is published. It includes reports on the Geological Survey of two counties, Monroe and Putnam; descriptions of new fossil Invertebrata, by R. P. Whitfield, and a synopsis of the recent Mollusca, by Frederick Stein, M.D.——Calvert and Neumayr publish in the Denkschriften of the Wiener Akademie, an article on the Tertiary formations of the Hellespont. They refer the latter to two divisions which are unconformable to each other, of which the inferior is upper Miocene. Fossil remains of *Vertebrata* and *Mollusca* are abundant and are described by the authors.——A deposit of carbonate of lead and silver carrying chloride of silver and embolite, forming the surface of a considerable hill, has recently been found in Southwestern New Mexico, by George Daly. It resembles the formation at the Silver King mine of Arizona, but is more extensive.——Mr. S. A. Miller, in the Journal of the Cincinnati Society of Natural History, continues his history of American geological work. His last article (April, 1881) covers the later writings on the Tertiary periods, but does not conclude this part of the subject. It covers forty-three pages, octavo, and includes much information of importance to geologists, in a condensed and conveniently accessible form. Lists of the fossil species are given.——In the same periodical, Professor A. G. Weatherby describes a number of new species of *Crustacea, Cephalopoda* and *Crinoidea* from the Silurian and Subcarboniferous rocks of Ohio and Kentucky. They consist of species of *Isochilina, Proetus, Cyrtoceras, Colpoceras, Trematodiscus, Reteocrinus* and *Heterocrinus.*——In the Proceedings of the Philadelphia Academy, Professor Heilprin discusses the fossils and age of the Lower Eocene formation of Clarke county, Alabama.

## GEOGRAPHY AND TRAVELS.[1]

SIBERIA IN EUROPE.—Mr. Henry Seebohm, to whom we are already idebted for much valuable information concerning Siberia,

[1] Edited by ELLIS H. YARNALL, Philadelphia.

has now prepared a full account[1] of his journey to the valley of the Petchora, which was made previous to a longer journey through Asiatic Siberia as far as the Yenesei. The portion of the Russian dominions described in this volume occupies the north-eastern corner of Europe, and lying within the Arctic circle, is a dreary, monotonous land, with nothing to tempt the ordinary traveler. Its great morasses are always frozen at a foot below the surface and much of the firmer land, when not under the snow, is covered by water from the flooded streams.

Mr. Seebohm's and his companion, Mr. Harvie-Brown's object in visiting the Petchora, was principally to complete their studies of ornithology of Northern Europe, and whilst entirely successful in this respect, they have also collected much valuable information for the geographer regarding this remote region. Mr. Seebohm having previously visited Norway, with a similar purpose, on his return compared the results of his investigations with those made about the same time by Mr. Harvie-Brown in the valley of the Dwina near Archangel. The difference between the birds in these two countries was very striking, and it was concluded that by pushing their explorations ten degrees further eastward, they would find the breeding ground of birds whose nests had never been seen, though known as migrants in southern and western Europe.

The species which excited the keenest interest were the gray plover *(Squatarola helvetica)*, the little stint *(Tringa minuta)*, the sanderling *(Calidris arenaria)*, the curlew sandpiper *(Tringa subarquata)*, the knot *(T. canutus)*, and Bewick's swan; but many other rare birds might also be reasonably expected to breed in the same district.

The travelers set out from London, in March, so as to reach the Petchora before the melting snows and the resulting floods made further progress impossible. Passing through St. Petersburg and Moscow, they reached the end of the railroad at Vologda and continued their journey by a sledge ride of six hundred miles to Archangel. From here to Ust-Zylma, on the Petchora, is a distance of over seven hundred miles. "A fortnight after arriving at Ust-Zylma," says Mr. Seebohm, "the snow became impassable, the winter road was broken up, the horses at the stations in the uninhabited portions of the country, a distance of two hundred and fifty versts, were sent home, and for two months the valley of the Petchora was as completely cut off from all communication with civilized Europe, as if it had been in the moon." One hundred and fifty miles of impassable swamp barred all communications. Ust-Zylma is a large, straggling village, most of whose inhabitants belong to a sect known as "Old Believers." Outside

[1] Siberia in Europe; a Visit to the Valley of the Petchora, in North-east Russia; with descriptions of the Natural History, Migration of Birds, etc. With Map and Illustrations. By Henry Seebohm, F.L.S., London, 1881.

the village were several camps of Samoyedes, of whose life and customs much is told.

On the opening of navigation the travelers embarked on a small steamer and descended the Petchora to its delta, east of which was the *tundra*, "a wide expanse of moorland covered with lichen, reindeer moss, dwarf shrubs and birch, with swampy patches and morass into which it was impossible to sink more than a foot deep, owing to the frozen pavement below." Their exertions here received their reward in the valuable collections of birds and eggs obtained. On the first of August they broke up their camp on the tundra, and embarking on a steamer, passed around the North Cape, and after a voyage of thirty-five days, reached Elsinore.

The collections brought back include eggs of the gray plover and the little stint. Excellent wood cuts, illustrating the country and its natural history, are given and a very satisfactory summary of the scientific results of the journey is added.

COLONEL PREJEVALSKY.—The Royal Geographical Society's *Proceedings* states that, having reached home, this eminent traveler intends "to devote himself for some time to the preparation in retirement of a great work on the results of his travels, including besides his recent expedition to Tibet, his previous journey to Lobnor, of which he was prevented, by want of time, from giving more than a bare outline. The work is to consist of eight volumes, and to be entitled "Travels in the Deserts of Central Asia." Volumes I and II will contain the narrative and an account of the physical geography and ethnography of the countries he has visited, and will include also his surveys, the pictorial illustrations being from original sketches by his companion, Lieut. Robarofsky. Volume III will be devoted to the mammalia of Central Asia; Volume IV to the birds; Volume V to the reptiles, amphibia and fishes; Volume VI to the flora of Mongolia; and Volume VII to that of Tibet. Volume VIII and last will contain the geology and mineralogy as far as materials will permit. The first two volumes, each containing five hundred pages and perhaps more, will be written by the traveler himself, and will appear towards the close of 1882. The ornithology will also proceed from his pen, as well as that portion of the zoölogy which treats of the antelope, buffalo, and a few other of the more important animals. The remainder will be written by the academicians Strauch and Maximovitch, Professors Kepler, Inostrantsef, and Bogdanof, and will be issued in parts. The whole will not be completed for several years. The work will be brought out under the auspices of the Russian Geographical Society and a special grant for the purpose will be asked for from the Emperor."

M. DE BRAZZA'S JOURNEY FROM THE OGOWE TO THE CONGO.—One of the most remarkable of recent journeys in Africa is that of M. de Brazza. We noticed his starting from his station near

Mashogo, on July 14, 1880,[1] for the Congo. No details of his journey have been received, but he succeeded in reaching the Congo at Ntamo-Nkouma, about one hundred miles south of the equator or between 2° and 3° south latitude and between the river Mpaka-Mpama and the Lawson(?). Gaining the favor of King Makoko, he was able peacefully to descend the Alima to its junction with the Congo. On October 3d, he founded the station Ntamo-Nkouma, on land ceded by the king, on the right bank of the Congo. Makoko is King of Ubanji (Ubangi-Stanley). The distance by this route from the Ogowé to the Congo is twelve marches, over a plateau of an average height of eight hundred metres. The country is healthy and the population dense and peaceful. He left a sergeant and three men at Ntamo-Nkouma,who can be supplied and revictualled from Ogowé station by an easy route.

Descending the Congo in boats in November, he arrived at Mdambi-Mbongo, about long. 14° east, the advanced post of Mr. Stanley, whom he met and with whom he reached the latter's headquarters at Vivi, on November 12th. He reached the Gaboon, on December 16th. In two days he started again for the Ogowé and the basin of the Congo. His first station, Mashogo, is in the country of the Okandi. This tribe is devoted to agriculture, and food is plentiful in their country. M. de Brazza has now taken with him, in sections, a small steam vessel, which has been lately built of steel expressly for his explorations, and after reaching the upper course of the Ogowé he hopes to be able to get it conveyed to the Alima or one of the other affluents of the Congo.

M. de Brazza is the first European traveler, who has penetrated into the interior of equatorial Africa from the west coast. He believes the Ogowé to be the best means of communicating with the interior, as the Congo is so interrupted by cataracts and rapids.

STANLEY ON THE CONGO.—The permanent station on the Congo of the Stanley expedition is on an elevated plateau below the Yellala falls. It is now a small town containing the dwellings of Mr. Stanley and his European staff, workshops, warehouses, and huts for his laborers and a garden producing vegetables of almost every description. From the river's edge to a distance of about thirty miles upwards along the hilly banks of the Congo, where he has established his second depot, a road about twelve feet wide has been constructed, serviceable for carts and wagons, which latter together with twenty donkeys have recently arrived from Europe, to be employed in the transport of stores and supplies. In addition to the Zanzibar people brought round to the Congo by Mr. Stanley, he has obtained the services of a large number of natives, from the lower Congo, and has with him in the in-

[1] See NATURALIST, February, p. 167.

terior about one hundred and twenty-five; while at Vivi, which is under the charge of his agent, Mr. Sparhawk, the laborers are all from Kabenda, under agreement to serve for a fixed period, it having been found that the tribes in that part of the country are not to be relied upon for regular work.

The trade on the Lower Congo is very large and increasing. The highest point where traders are established is at Noki, twelve miles below Vivi, which can be reached by vessels drawing eighteen feet of water at any season without the least difficulty. Above Noki no vessels have been, but there seems little to prevent their ascending as far as Vivi.

The above statement of Mr. Stanley's progress in given on the authority of the R. G. S. *Proceedings*, but other accounts obtained from visitors to Vivi speak of Mr. Stanley's road as a gigantic undertaking of very great cost, which will not be completed for several years yet, and indeed it is thought doubtful if it will ever be practicable for wheeled vehicles.

Meanwhile a missionary party under Mr. A. McCall is working its way to the Upper Congo by the north bank of the river, having erected a permanent station at Mataddi Minkanda, opposite Vivi. At last accounts they had arrived within three days' march of Manyanga (about E. long. 15° S. lat. 15°). Mr. McCall hopes to be able to reach Stanley Pool this coming autumn.

AFRICAN EXPLORATION.—Dr. Buchner, the German traveler in West Central Africa, spent the first six months of 1880, in Mussumba, the capital of the Muata Yanvo, making many interesting investigations into the topography and natural history of the country. The Muata Yanvo refused to allow him to proceed northward from his dominions, so departing from there on the 1st of July, he crossed the Lulua, sent back most of his people and his collections to Angola, and started for the north with fifty men. His astronomical observations necessitate great alterations in the measurements made by Schütt.——Herr Gerhard Rohlfs, having been sent by the German Emperor with presents and letters to the ruler of Abyssinia, has left Massaua, accompanied by Dr. Stecker, and reached the plateau of Abyssinia by very steep, difficult paths. Starting from Ailet, up to which place they had traveled under an Egyptian escort, they accomplished the ascent to Kasen, situated more than eight thousand feet above the level of the sea, without loss of baggage or animals. All along the track the country presented the most savage, but, at the same time, the most picturesque aspect. The valleys and mountain slopes were everywhere covered with a most magnificent tropical vegetation, consisting of gigantic sycamores, wild citron trees, mimosa, etc., densely intertwined with luxuriant creepers; and as day after day the travelers climbed the summits of mountain ranges or descended into deep valleys, the flora and the abundantly represented fauna of the country exhibited the utmost variety. Dr.

Stecker has sent home a detailed description of the country surrounding Massaua, together with meteorological observations, which will shortly be published.——An expedition sent out by the French government from Senegal to the Niger, has reached Segou-Sikorro, on the Niger, and found the Sultan well disposed and willing to allow the French to navigate and trade on the Niger. Captain Gallieni, commanding the expedition, finds that near Bamaku, the water shed of the Niger and Senegal basins, is only a few miles from the former river and the water parting is so indistinctly marked, that during the rainy season the water flows sometimes into one river and sometimes into the other.——Recent explorations by French travelers show that the western Sahara has considerable tracts of lands that can be reclaimed and fertilized by boring artesian wells, and where this has been done luxuriant gardens planted with date, fig, and other fruit trees, and fields of barley have taken the place of stunted shrubs or bare, sandy soil. The land of Adrar in the south-west is placed like a long narrow island between two bands of sand and contains a considerable population. Yet while the skill of the French engineers would no doubt overcome the natural difficulties in the way of the railroad projected through this region of sand hills, it is not easy to understand how a paying traffic could be secured or how the road could be protected from the hostility of the natives.——Great activity continues to exist on the east coast of the African continent, where many expeditions continue to enter, chiefly from Zanzibar. The strictly scientific exploring parties are outnumbered by the missionary companies, but none of them have added much of late to our knowledge of this portion of Africa, their letters relating simply their advances from station to station, and often containing sad stories of misfortune, starvation, or death. At the same time permanent stations have been established in the interior and on Lake Taganyika, and more successful results may reasonably be expected in the future.

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## MICROSCOPY.[1]

Examination of Metalliferous Clays.— Mr. Melville Atwood, in a paper on the clays in the Comstock lode, read before the San Francisco Microscopical Society, describes as follows the method of separating and examining the gold-bearing fragments.

"The way in which I made the examination of the clays was, first, to place them in a porcelain dish, pouring hot water over and keeping them in the water for several hours, stirring occasionally, till all the particles that would dissolve were taken up by the water. Afterward I emptied the contents of the porcelain dish into a batéa, allowing everything that was dissolved to float away. By the batéa the pyritic matter and other heavy bodies

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

were separated from the rest of the coarser, rounded and lighter fragments of vein-stuff and country rock. The pyritic matter is then tested for gold, silver and tellurium, and also a microscopic examination of it is made under water. The fragments of country rock and vein-stuff are then washed again, using a brush to rid them of any clay that might still adhere to them. After drying, they are put into a separator having sieves with 30, 50 and 100 holes to the linear inch—a uniform size enabling me to examine them better with the microscope. The fragments that pass through the sieve having 100 holes, I place in a small cell, fastened on the glass slide, and filled with water, which I cover with thin glass—the shape of the fragments are seen much better in this way, since by slightly moving the thin glass cover, they can be made to turn and exhibit their forms in different directions.

Arranging Small Objects on Slides.—Mr. Julien Deby proposes to facilitate the arrangement of diatoms, foraminifera and other small objects on slides for mounting, by drawing on the plain mirror of the microscope regular lines in crosses, circles, or any desired patterns. The achromatic condenser being so focussed that the image of these lines shall be in focus of the objective at the same time with the object slide, there is no difficulty in similarly arranging the objects by hand or by means of a mechanical finger.

The Hartnack Microscopes.—It is now eleven years since Hartnack was—in common with other Prussians during the Franco-Prussian war—compelled to leave France. He immediately settled in Potsdam, and there established an optical factory for microscopical work. M. Prazmowski, who had been for several years working with Hartnack, was admitted into partnership, and took entire charge of the house in Paris. The exhibit of microscopes, &c., at the Paris Exhibition of 1878, was by the firm Hartnack & Prazmowski. Since that date the partnership has been dissolved; the Potsdam house remaining exclusively Hartnack's, and the Paris house Prazmowski's. It is well known in Paris that to M. Prazmwoski's mathematical attainments have been due the improvements developed by the house during the past fifteen years or more.—*F. R. M. S. in Eng. Mechanic and World of Science.*

New Sea-side Laboratory.—Professor A. Hyatt, the curator of the Boston Society of Natural History, announces that a seaside laboratory will be opened, this year, under his direction, at Annisquam, Mass., three miles from Gloucester, from June 5th to September 15th. The laboratory, which is designed rather for teachers or students of some experience than for beginners in Natural History, will be under the immediate care of Mr. B. H. Van Vleck, assistant in the Museum and Laboratory of the Boston Society of Natural History. Students are advised to bring their own

microscopes. Only a limited number of students can be accommodated; and applicants should state the amount of their previous experience in such work.

MICROSCOPIC OBJECTS.—Mr. M. A. Booth, of Longmeadow, Mass., is furnishing unmounted objects, by mail, at the price of one dollar for twenty-five packets. Printed lists of the objects offered can be obtained from him.

Mr. Geo. W. Morehouse, of Wayland, N. Y., has issued a list of mounted objects, chiefly animal substances and preparations of various kinds, which he is offering for sale at thirty cents each, or four for one dollar.

Mr. David Folsom, of Chicopee, Mass., has also undertaken to prepare objects for sale, or mount them to order.

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## SCIENTIFIC NEWS.

— At the last meeting of the State Natural History Society of Illinois, Professor J. G. Forbes said that the time for argument in scientific societies respecting the truth of the doctrine of evolution had passed, as scientific men were substantially agreed that it was either strictly true or a close approximation to the truth. He traced the rapid progress of the doctrine in this country, accounting for this by the fact that naturalists found its principles continually verified by new discoveries springing up all over the earth. This point was illustrated by some of his own observations on the development and anatomy of certain fishes, of which he had made a special study.

Passing to the application of the development theory, the speaker took up, as an instance of its practical uses, the subject of the restocking of our waters with their native species of fish. He criticized the idea put forward by prominent fish-culturists, that fishes could be artificially multiplied to such a degree that it would make no difference how or when or in what numbers, they were captured, showing that this idea involved a contradiction of the doctrine of natural selection. The conclusion was reached that the protection of fishes was fully as important as their artificial multiplication. He showed that the food supplies of fishes were diminished by the drainage of swamps, restriction of overflows by levees, and other operations attendant upon the settlement of a country; and that it was therefore not to be expected that the fishes of a body of water could be permanently kept up to as high a number as occurred there naturally in a state of primeval nature.

— The fourth session of the Marine Laboratory maintained by the Johns Hopkins University in connection with its biological department, will commence at Beaufort, N. C., May 2, 1881. The session will continue until the end of August. Dr. W. K. Brooks,

Associate in Biology and Assistant Professor of Comparative Anatomy, will be in immediate charge as director.

The Laboratory is provided with a steam launch; small boats, nets, dredges, aquaria, microscopes, reagents, and a small reference library are also supplied by the University, for their use. Those admitted to the Laboratory will be charged a fee of $25.

The Marine Laboratory is designed for advanced students and for those qualified to carry on original investigation. No definite courses of instruction will be given, as the persons received will be presumed to have sufficient knowledge to carry on their studies without such aid. Dr. Brooks will, however, exercise a general supervision, and control and direct the daily work of the Laboratory. Board and lodging may be obtained in the town of Beaufort near the Laboratory, for from $20 to $30 per month.

— That germs of disease may live long, seems to be proved by recent experiments of a French Committee directed by M. Pasteur. Seven sheep were led daily, for a few hours, to a piece of ground where some animals that died of anthracoid disease, or *charbon*, had been buried *twelve years previously*. Two of them caught the disease and died. There was no grass for the sheep to eat, and it is thought those two must have received the germs in the course of smelling about the ground, as sheep generally do. It may be added that on some ground of that farm, where diseased animals had been buried, vegetables are now grown; and M. Pasteur asked the farmer if any employés, etc., about the farm have been affected. He knew of none, but showed a healed sore of malignant pustule (the same kind of disease) on his own face. M. Pasteur supposes that if the vegetables eaten had not been cooked, there might have been a different tale. The disease, too, might be communicated by the agency of insects, etc.— *English Mechanic.*

— Pasteur has found on taking fowl cholera poison from a a fowl which has died, not of acute but of chronic disease, and cultivating this in several solutions of fowl-broth, that on transferring it in succession from one to the other, it suffers no diminution of its virulence in the passage. However, experiments made by varying the length of the periods of time during which the solutions are left intact, after having the parasite added to them, show that the time allowed for its development is an important element in the question. Thus, with intervals of only from one day to two months between any two successive inoculations of the solutions, no modifications of their virulence is experienced; though in proportion as the interval is increased, signs of such a modification appear in the slowness with which death occurs, and in the diminished acuteness of the preliminary symptoms.

— The Kansas Academy of Science, at their November meeting, appointed a Commission to memorialize the Legislature in

reference to a State Survey. Two preliminary surveys under Professors Mudge and Swallow have already been made. A more extended and thorough scientific survey is now needed. The most active geologist now in the field in this State is Professor O. W. John, who for two years past has studied the stratigraphical geology of eastern Kansas.

— Last summer Professor F. H. Snow, with several assistants, spent over a month in Santa Fé Cañon, New Mexico, as well as in Colorado, and made important entomological collections, among them were twelve new species of Coleoptera, and an interesting collection of geometrid moths, comprising a number new to the Colorado plateau region.

— The French zoölogical station at Roscoff has been making good progress of late. It has now an aquarium of one hundred square meters extent, and a good steamer for excursions; and is soon to be provided with a pond and a diving dress. M. Lacaze-Duthiers, who founded this station, announces the establishment of a second one at Port Vendres.

— The death is announced of Dr. John Jeremiah Bigsby, F.R.S., a well-known writer on palæozoic fossils, at the advanced age of 88 years. The greater part of his life was spent in Canada and in the United States, and his writings on American geology date back to 1820, when he contributed a paper to *Silliman's Journal.* Dr. Bigsby's best-known works are his "Thesaurus Siluricus," which appeared in 1868, and his "Thesaurus Devonica-Carboniferus," published ten years later. The "Bigsby Medal," which he presented to the Geological Society of London a few years ago, was awarded at the anniversary meeting on Friday, the 18th inst, to the French geologist, M. Charles Barrois.

— Professor Tennant, for many years professor of geology in King's College, London, died early in March, aged 72. Gabriel Koch, a well-known lepidopterist of Frankfort-on-the-Main, died in February, aged 80; also Professor Gorini, of Lodi, known by his works on volcanic phenomena.

— Edward R. Alston died at the age of 35 years, was born in Lanarkshire, Scotland. He was an excellent zoölogist. His most important paper is a monograph of the classification of the order of *Rodentia*, published by the London Zoölogical Society in 1876.

— George B. Emerson, LL.D., well known for his love of nature, and as the author of a "Report on the Trees and Shrubs growing naturally in the Forests of Massachusetts" (1846), which lately passed through a second enlarged and illustrated edition, died in Boston, in March. He was born in Kennebunk, Me., Sept. 12, 1797. He taught in Boston many years, wrote on educational topics, was President of the Boston Society of Natural History, and a liberal patron and friend of Science.

## PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN PHILOSOPHICAL SOCIETY, Philadelphia, Oct. 15, 1880. —A letter from Dr. Henry Draper announcing the successful photographing, in fifty minutes, of the Orion nebula, was read; and Dr. Barker made some remarks in regard to the discovery. Mr. Lesley described a kitchen-trash heap at Saltzburg, Va.

Nov. 5.—Dr. Horn presented two papers for publication in the Proceedings, entitled, "Critical notes on the species of Selenophorus of the United States," and "A review of the species of Anisodactylus inhabiting the United States." Mr. Lesley exhibited some recently executed works of the State Geological Survey.

Nov. 19.—Mr. Lesley exhibited and described three models in plaster, 1st. Of the seven mountains in Middle Pennsylvania, surveyed by Chas. E. Billin; 2d. Of the Stone mountain fault, by the same, and 3d. Of a part of the Middle Anthracite Coal field, constructed from the first specimen sheet map of the Anthracite Survey, by Mr. Chas. A. Ashburner.

Dec. 3.—A communication entitled, "On the Vertebrata of the Wind River Eocene bed, of Wyoming, by E. D. Cope," was read by title. Dr. König remarked on two specimens of silver ore from near Ouray, in Colorado.

Dec. 17.—Prof. Cope remarked on the fossils of the Wind River Eocene beds.

Jan. 7, 1881.—A paper on Photodynamics was read by Professor Chase. A note on the protection of oil tanks from lightning stroke, by B. Howard Rand, and extracts from letters on the discovery of Permian shells in the Upper Coal measures at Wilkesbarre, by Dr. Ingham, were read. A MS. map of the geology of parts of Lee, Wise and Scott counties, Va., by J. J. Stevenson, was presented by Mr. Lesley. Mr. Lesley exhibited a map of Pennsylvania, showing the progress of the survey since 1874.

Feb. 4.—Professor J. J. Stevenson communicated a paper entitled, "The Upper Freeport Coal bed along Laurel ridge, in Preston county of West Virginia."

Feb. 18.—A communication was read, entitled "Certain almanacs published in Philadelphia between 1705 and 1744, by Henry Phillips, Jr."

March 4.—Mr. Lesley read a paper entitled, "Notes on the meaning of the word *Hebrews*, and on Egyptian names of Hebrew kings."

March 18.—A paper "On the Preglacial drainage of the Great lakes, by Dr. J. W. Spencer," was read by the secretary. "A geological section at St. Mary's in Elk county, Pa.," was explained, and the importance of its consequences noted, by Mr. C. A. Ashburner.

PHILADELPHIA ACADEMY OF NATURAL SCIENCES, Nov. 9, 1880. —Rev. Dr. McCook spoke on the habits of Basilica spiders and their mode of constructing the dome-shaped webs and the cocoon.

He asked for information regarding the use, by birds, of the spinning work of spiders in the construction of their nests. Dr. König spoke on Beegarite.

Nov. 16.—Mr. Meehan remarked on the sexual organs of Andromeda. Mr. Potts gave the names of the new species of fresh-water sponges collected in Fairmount Park, and spoke on the characters of some other forms observed by him.

Nov. 23.—Dr. McCook spoke on the enemies of spiders.

Nov. 30.—Mr. Ryder gave an account of the development of *Mya arenaria*. Mr. Meehan spoke on the germination of seeds. Dr. Parker remarked on the morphology of the occipital lobes of the brain. Dr. Dercum spoke on the termination of nerve-fibers.

Dec. 7.—Dr. McCook spoke on the protective instincts and industries of the spiders. Mr. Potts remarked on the feeding habits of ants.

Dec. 14.—Professor Allen spoke on the phalanges of the bat's wing. Mr. Ryder described *Zygonopus whitei*, a new myriapod from a cave in Virginia.

Jan. 4, 1881.—Dr. Leidy spoke on the use of rhizopods as food for fishes.

Jan. 25.—Dr. Horn spoke on the mouth organs of the Carabidæ and their value in classification.

Feb. 1.—Mr. Ryder remarked on Protozoa of Europe and the United States.

Feb. 8.—Mr. Meehan remarked on the lack of trees on prairies. Mr. Bassett spoke on Hymenoptera producing galls.

Feb. 22.—Dr. McCook remarked on analysis of honey and development of abdomen of ants. Dr. Kite spoke on the skulls of hornbills.

March 1.—Mr. Potts made observations on Spongilla. Professor Heilprin spoke on geological classification.

Boston Society of Natural History, March 16.—Dr. W. G. Farlon made some observations on the plants of Bermuda, and Professor N. S. Shaler discussed the advance and recession of glaciers.

American Geographical Society, March 25.—Lieut.-Commander H. H. Gorringe, U. S. N., read a paper entitled, A cruise along the northern coast of Africa.

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## SELECTED ARTICLES IN SCIENTIFIC SERIALS.

The Geological Magazine.—March. On the traveled blocks of the Upper Punjab and a supposed Glacial period in India, by A. B. Wynne. Prehistoric Europe and the Cornish Forest beds, by W. A. E. Assher. "Laccolites," by G. H. Kinahan.

The Canadian Entomologist. — January. Observations on several species of Ægeriodæ inhabiting the vicinity of Buffalo, N. Y., by D. S. Kellicott. Description of the preparatory stages of *Papilio philenor* (Linn.), by W. H. Edwards.